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CALIFORNIA FISH AND GAME

"CONSERVATION OF WILD LIFE THROUGH EDUCATION"

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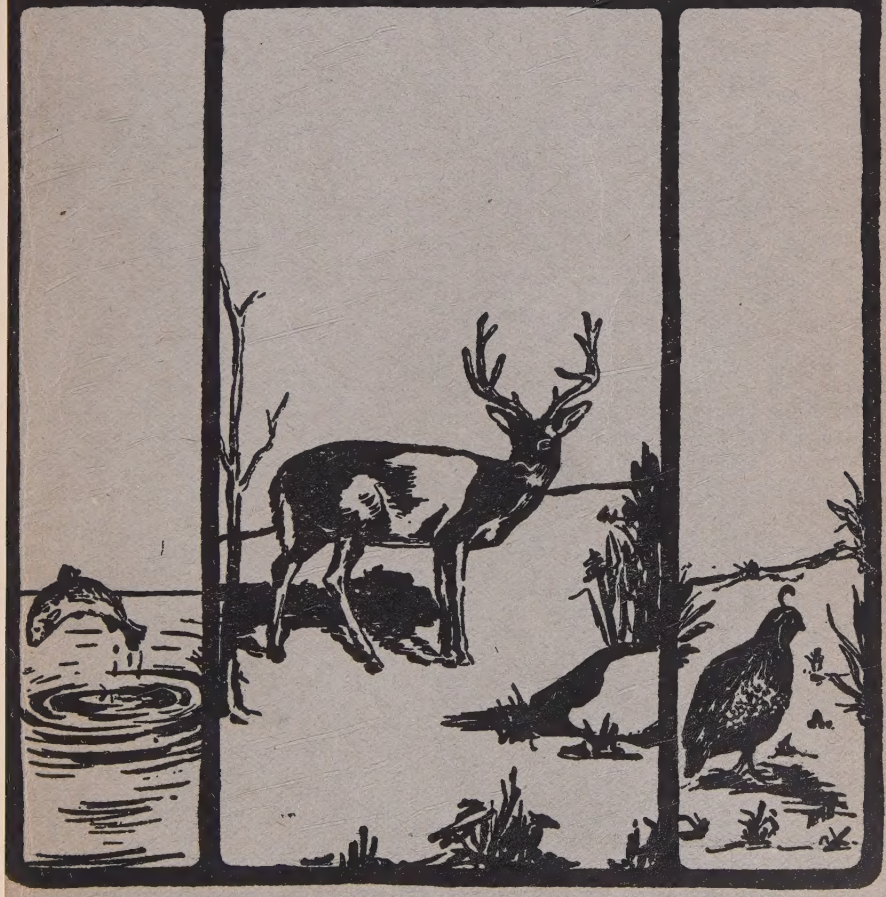

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SHRIMP FISHERIES OF CALIFORNIA.

By N. B. SCOFIELD.

As the question of removing the restrictions on the Chinese shrimp or bag nets periodically arises at each session of the legislature, it is thought best to give a brief history of the shrimp fishery in the state and to describe the fishery as it has existed in the past in order that those who care to can learn of the great destruction to young fish and young shrimps by the Chinese method of fishing.

The only account of the earliest shrimp fishing operations in the state is supplied by Mr. A. Paladini, the venerable fish dealer of San Francisco. He came to San Francisco in 1869 and engaged in shrimp fishing. There were eight boats on San Francisco Bay engaged in this

business, each boat manned by white men. They easily caught enough shrimps to supply the demand, besides many flounders, sole, tomcod, etc., for the fresh fish market. Fish and shrimps were very plentiful in the bay at the time. The shrimps caught were the same species as now, but were much larger than those caught in later years during the intensive fishing by the Chinese. This later reduction of the larger and older shrimps as noted by Mr. Paladini is good evidence that the shrimps were being subjected to overfishing. The early fishing of the eight boats of Italian fishermen was carried on with small-meshed seines, sixty feet long and eight feet deep, with a bag at the center. They used the nets in the deeper water of the bay for there the catch was freer of young fish and of the small unmarketable shrimps. The manner of fishing was to lay out the net, then anchor the boat down the tide and pull the net along the bottom toward the boat by means of lines, always pulling with the tide. The net was pulled directly into the boat. They would make from three to five hauls on each tide and they caught from fifty to seventy-five pounds of shrimps at a haul. This method of fishing was far less destructive to young fish than that employed later by the Chinese. They could fish in deeper water, where young fish and young shrimps were fewer, and unlike the Chinese nets which are set during the whole tide and kill practically all the young fish caught, they were in the water only a short time—less than one-half hour—and the small per cent of young fish caught were still alive and could be returned to the water. The shrimps thus caught were sold fresh at the Long Wharf. Little thought was then taken as to whether a method of fishing was destructive or not and there were few laws protecting fish, for it was thought that the supply of fish in the bay and rivers was inexhaustible. The Chinese had for some years been in the fishing business and with their destructive methods of fishing had already begun the extermination of the Sacramento perch and with their fiendish sturgeon lines had inaugurated a method of fishing that has resulted in the commercial extinction of that valuable fish which in the early days was here in apparently inexhaustible numbers.

In 1871 the Chinese began fishing for shrimps and introduced the destructive Chinese shrimp net. They made enormous catches with these fine-meshed set nets and found it profitable to supply the markets with shrimps at one and one-half cents per pound. The original eight Italian shrimp boats were driven out of business and since that time shrimp fishing has been almost entirely carried on by Chinese. From the very start the Chinese dried the bulk of their catch for the Oriental export trade. The shrimp fishery quickly grew to large proportions and fishing was carried on at many places in San Francisco Bay and in Tomales Bay in Marin County.

The first printed account of the shrimp fishery is contained in Vol. II of "History and Methods of the Fisheries" by Goode, printed in 1885 by the United States Bureau of Fisheries. A more extensive investigation of the fishery was made by the author for the California Fish and Game Commission in 1897. A subsequent investigation was made by the author in 1910. There has always been serious objection to the Chinese method of catching shrimps, and much of the legislature's time has been taken up by listening to discussions between those who would

conserve the fisheries resources of San Francisco Bay and rivers, on the one hand, and the interested defenders of the Chinese, on the other. Closed seasons were finally resorted to and the drying of shrimps was prohibited, without greatly reducing the destruction of young fish. At the 1910–1911 session of the legislature the use of Chinese shrimp nets was prohibited entirely. The shrimps had been so reduced in numbers that it was found unprofitable to catch them by the method formerly employed by the Italians. It was also found to be unprofitable to employ the shrimp trawl which was in successful use on Puget Sound. In 1915 the legislature removed the restriction against the Chinese net in South San Francisco Bay on the ground that in that part of the bay the destruction to young fish was much less than in the upper bay and for the further reason that in that part of the bay the kinds of fish destroyed did not include the young of herring, smelt, shad and striped bass as was the case in the upper bay. At the 1916–1917 session of the

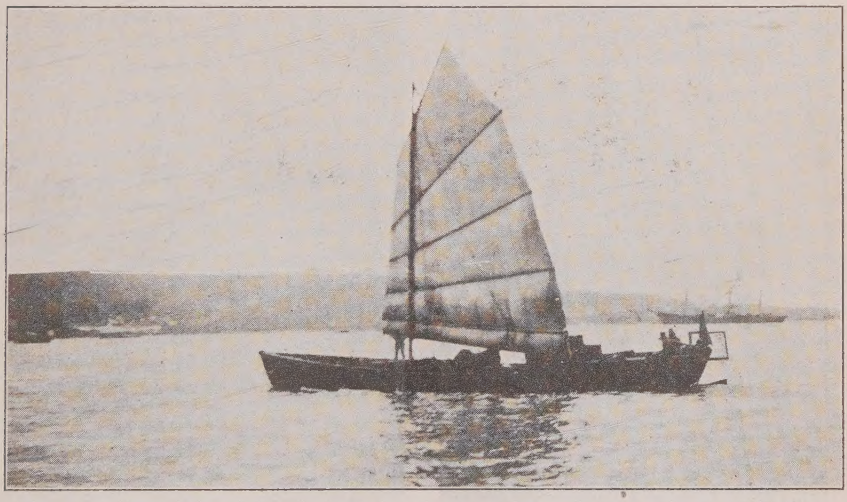

Fig. 1. Chinese shrimp fishing junk on San Francisco Bay. Photograph by H. B. Nidever.

legislature a very strong effort was made to reestablish the fishery in the upper bay by those who would be benefited in the way of rents, selling of supplies, etc., and by those who would have the picturesque industry for sentimental reasons. As this effort is sure to be resumed at the 1918–1919 session it is believed an intimate description of the industry as it existed up to the year 1910 will be of interest, especially as the Chinese now operating in South San Francisco Bay are using identically the same methods, with the single exception that they do not catch so many young fish in that part of the bay and the young fish caught are not of the more valuable species.

Camps: The fishing has been carried on by what has been termed "camps." Each of these camps is a separate unit, which has its own boat, wharf, boiling vat and drying ground, separate living quarters and storehouses. Although one Chinese company may have owned or controlled several camps, even side by side at the water's edge, they

did not co-operate in any way. The camps were very similar in character, consisting of a group of small, rude shacks of rough, unpainted boards, placed near the edge of the water, with a rough wooden wharf running out into the shallow water on hand-driven piling which answered as a landing place for the camp's junk. Very few of the camps could be approached at low tide, for which reason they usually fished the flood tide in order that they might more easily bring their catch to the landing. The shacks which constituted the living quarters and storehouses were, in the majority of cases, crowded on a narrow beach between the water and the hills. The dry grounds of each camp covered about an acre of the slope of the hills for the want of a better

Fig. 2. Scenes on board Chinese shrimp junk on San Francisco Bay. Photographs by H. B. Nidever.

place, and were usually floored with boards. In two or three of the camps the drying ground was partly on a platform built out over the water. In 1897 there were 26 camps operating on San Francisco Bay and in 1910 this number had been reduced to 19. The camps on Tomales Bay were abandoned some years prior to 1897. Of the 19 camps found in 1910 three were in the cove just above South San Francisco, five were at Hunter's Point, four in Contra Costa County south of Point San Pablo in Marin County. The three camps near South San Francisco were controlled by one company, the Fook On Lung Company of San Francisco. They furnished no fresh shrimps for the market but dried their entire catch. Their fishing ground was in Alameda County about three miles east of San Bruno Point. Each

of their three junks used sixty Chinese shrimp nets such as are described under "Methods of Operating Nets." Two of the five Hunter's Point camps, located on the south side of the point, were owned by the Quong Lee Chong Company of San Francisco. Each of the two boats fished forty nets and they dried their entire catch. Their fishing ground was about a mile off shore, a little west of south from the point, which brought them within San Francisco County. Of the three camps on the north side of the point, the two camps nearest the point were controlled by the Fook On Lung Company, also known as the California Shrimp Company. The third camp on the north side of the point belonged to the Union Shrimp Company, a Chinese company of San Francisco. The three last-named camps sent part of their catch to the fresh shrimp market and dried the rest. They fished in Alameda County a mile south of the Alameda mole. The four Red Rock camps were located in a cove on the Contra Costa shore about two miles to the south of Point San Pablo. These camps belonged to the Union Shrimp Company of San Francisco and their four boats fished just to the north of Red Rock in water from four to six fathoms deep. This depth is greater than that fished by any of the other boats and it was not possible for them, on account of the depth and tide, to use more than thirty nets to each boat. Part of their catch went to the fresh market but the main part was dried. Of the seven camps near Point San Pedro, Marin County, one was situated in the first cove to the south of the point near the rock quarry. It was an independent company drying most of its catch but selling a few to the Union Shrimp Company, for the fresh market. Their boat fished about one-half mile southwest of the point. The next camp to the north of the point belonged to the Union Shrimp Company. Its boat fished about one-half mile off shore and sometimes across the channel in Contra Costa County. This camp sent part of its catch to the fresh market but dried most of it. One-half mile further to the north was a Quong Lee Chong Company camp and next to it in the same cove a Quong Sing Lung Company camp, while just to the north in the next cove was a second camp of the Quong Sing Lung Company and next to this two other Quong Lee Chong camps. These last five outfits named, dried their entire catch and their five boats operated sixty nets each. They fished far out on what is known as the "Petaluma Flats," the furthest boat fishing one-half mile due south of the outer Petaluma Creek Beacon, the other near but to the southwest. All five fished within the county of Marin.

The following description of the boats, nets and fishing methods applies to the industry today just as it does to the industry as it existed twenty years ago:

Boats. The boats used by these camps are of Chinese pattern and make. They vary in size, but the majority are about fifty feet long and twelve feet beam, with rounded bottoms without a keel, and with square sterns and rather blunt bows. They have one mast which carries a Chinese cleated sail. About fourteen feet of the stern is decked in and constitutes the living quarters of the crew. This compartment is entered through a small sliding hatch and there the five men of the crew cook their meals, eat and sleep. Just forward of this is the open shrimp locker, about twelve feet square, for holding the catch, and next forward is a locker of similar size for holding the nets.

The remaining space forward is used for lines and gear. On the deck between the crew's quarters and the shrimp locker is a crude wooden windlass placed horizontally and with four wooden spokes projecting by which it is turned by the hands and feet of the operator. From the drum of this windlass a line passes forward through a notch in the elongated bow post of the boat. This windlass and line is used to lift the series of nets from their fishing position at the bottom of the bay. The boats are of sufficient size to carry sixty wet nets and ten to twelve tons of catch.

Nets. Each separate net is constructed in the shape of a funnel. They are usually thirty-two feet long, with the larger opening or mouth about eighteen feet in diameter, from which the net tapers to the narrow opening a foot and one-half in diameter at the end of the sack. This narrow or cod end of the net is closed by a string which can be untied to remove the catch when the nets are pulled up. The nets are made in China from a very strong and durable twisted grass-like fibre. The net has a mesh of three and one-half inches near the mouth but the size rapidly diminishes toward the small end until the sack has meshes of one-half inch or less. This small-meshed end of the net, which has to sustain the weight of the catch when the net is pulled from the water, is usually reinforced by a net of coarse twine placed around the outside. In making the webbing of these nets square knots are used instead of the usual knot used by fishermen the world over. The nets are dried and tanned about once a month and with care they will last a year. Their cost is about $25 Mexican in China. After paying freight and other charges and adding the hanging line around the larger opening they cost here about the same amount in gold.

Method of Operating Nets. Each junk operates a set of nets, thirty to sixty in number, which are set side by side at the bottom of the bay with their larger openings or mouths open to the current. The nets are held in place by a series of brails or speaders—2x3 inch sticks of pine five feet long—each of which is held to a short stake driven in the bottom of the bay by a line from either end, of sufficient length to permit of the brails with the nets attached being lifted to the surface during the slack water between tides, without detaching them from the stake. The stakes to which the brails are attached are driven twenty-four feet apart across the current in the muddy bottom of the bay in a very ingenious manner. For driving these stakes a very long tapering pole is used with a four-inch iron pipe fitted on the larger end so that a hollow end of the pipe projects a couple of feet beyond the end of the pole. Selecting a stake with lines and brail attached, its head is inserted in the hollow end of the pipe where it fits loosely but is kept from falling out by holding on to the brail lines while the pole is held in the vertical position over the spot where it is to be driven. The pole with the stake in place is then lowered from the boat until the stake is pressed into the mud. The stake is then driven home by repeatedly lifting the pole a short distance and then lowering it forcibly. The stakes are driven twenty-four feet apart across the current so that each brail when it is in position with nets attached will stand vertically on the bottom in each space between the mouths of the nets. Attached in this way, the net mouths instead of being circular are now rectangular in shape, the opening being twenty-four feet across and about four and one-half feet

deep. To remove any uneven strain on the nets and to prevent their being carried away by the swift tide, a heavy anchor or stake is placed about fifty feet out from each end of the row of stakes and in line with them, from which runs a heavy line which is tied with a clove hitch to the center of each of the brails. By anchoring this heavy line in line with the stakes and sufficiently far out, the arrangement does not interfere with lifting the brails and nets to the surface of the water when the catch is to be removed just before the slack water at the end of the tide. Besides the heavy anchor line running from brail to brail, there is another and lighter one, the buoy line, which facilitates in lifting the nets. This line, when the nets are set in fishing position, extends from a floating buoy at one end of the string of nets to the first or end brail, to which it is tied by a bight about a foot from its top. From thence it runs to each brail in succession until the last brail at the end of the string of nets is reached, from whence it extends up to another buoy on the surface of the water. This buoy line is in place only when the nets are set. The nets are fastened to the brails

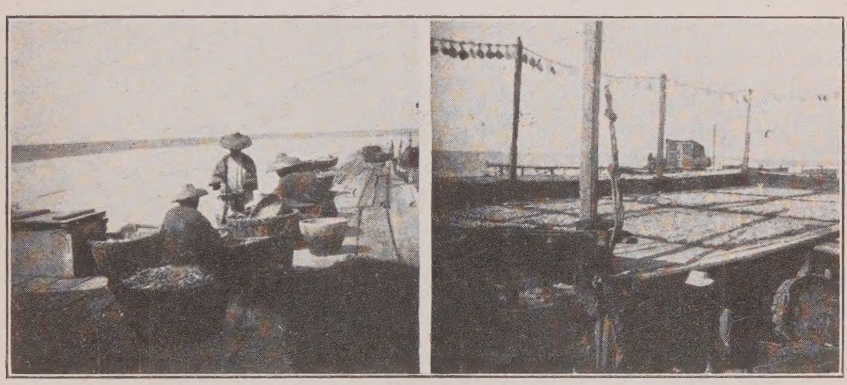

Fig. 3. Sorting and drying young fish obtained from shrimp nets, Point San Pedro, 1897. Shrimp fishing endangers the fisheries by destroying young fish. Photographs by N. B. Scofield.

and the buoy line is attached just after the turn of the tide before the current has become swift. The force of the current swings the series of nets down onto the bottom where they are held by the brail lines to the row of stakes, reinforced by the heavy anchor line. Here they are left during the entire tide, the time varying from four to eight hours, with their mouths open against the tide while the current carries the shrimps and young fish into them. With this manner of fastening the nets they can be used on either a flood or ebb tide.

When the nets are to be lifted at the end of the tide after the force of the current has slackened sufficiently, an end of the buoy line is taken at one of the buoys, passed through the notch in the bow post of the boat and thence carried back to the windlass, where it is reeled in by one man, thus bringing the first brail to the surface and lifting the net with it. The other members of the crew detach the net and the buoy line from the brail while the man at the windlass reels up the next brail. Thus the nets are detached in succession, the catch being emptied into the shrimp locker and the nets placed in the net locker. The

Chinese are very expert in handling the nets and work rapidly, each man with a particular duty to perform. The time in which the nets have to be lifted is limited usually to about half an hour. They can not begin sooner for the nets can not be lifted when the current is strong. If they are not gotten out before the tide turns the nets begin to swing the other way and they become tangled and the catch is lost. When tides are so strong that there is danger of carrying the nets away they reduce the current pressure by tying the upper edge of the nets farther down on the brails. If the tides are extremely swift they reduce the number of nets.

Shrimp Drying. After the nets are all lifted the junk sails back to the dock at its camp, where the catch is carried in baskets, Chinese

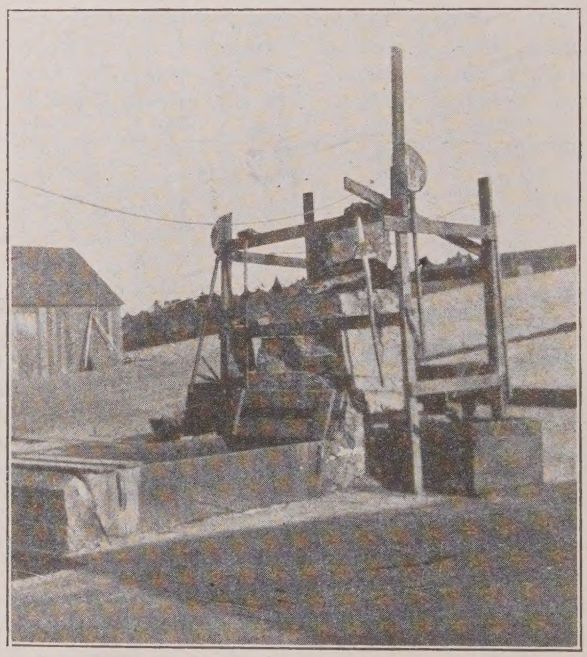

Fig. 4. Shrimp boiling vat, showing skimmers and rakes hanging on crude chimney. Point San Pedro, 1910. Photograph by N. B. Scofield.

style, to the boiling vat. This vat is about four by eight feet and eighteen inches deep, with wooden sides, the bottom being of sheetiron bent up around the sides. It is built in with bricks and mud and to heat the water both wood and coal is used. Fresh water to which rock salt has been added is used in the vats. The shrimps, together with the fish caught with them, are poured in, ten or twelve baskets at a time, and boiled from ten to fifteen minutes. They are then dipped out with a strainer and put into baskets to be carried to the drying ground. Here the shrimps and fish, the latter usually small and delicate with the flesh boiled from the bones, are spread out together to dry in the sun. When the weather is good the shrimps will dry in about four days, when they are gathered together and rolled with cleated, wooden rollers

to break the shells from the meats. The whole mass is then carried to a shed where it is run through a small fanning mill to separate the loose shells, fish bones and pulverized fish flesh from the heavier shrimp meats. By screening and hand picking the shrimp meats are divided into two grades, the unbroken meats in one and the broken meats in the other. They are then sacked, 280 pounds to the sack. The shells fish-bones and fish flesh, and all fine particles and dust are saved and put in sacks, 310 pounds to the sack, and sold for use as a fertilizer. The loss in drying is about 65 per cent, and for each pound of shrimp meats there are two pounds of fertilizer or "shells."

Drying Fish. The amount of young fish taken in the Chinese nets is always large, varying from 10 to 75 per cent of the entire catch. Formerly large quantities of these fish were dried. The larger fish were picked out and hung on strings to dry while the very small fish, principally the young smelt (*Osmerus thaleichthys*) were dried on trays which had been covered with discarded net webbing. The small fish were separated from the shrimps by dumping a basket of the catch in a small vat of cold water where the live shrimps sank to the bottom, thus allowing the small dead fish to be easily skimmed from the top. After being prosecuted for catching young fish they ceased to dry the small fish and boiled them with the shrimps to get rid of the evidence as quickly as possible. They were nearly as valuable as a fertilizer as they were as a food product. There has always been this incentive to catch the young fish and experience has shown that it is impossible to operate the Chinese net without catching great quantities of immature fish, thus causing great damage to the fisheries of the bay and rivers.

Fresh Shrimps. In the camps that sent fresh shrimps to the markets they had a special shed at the wharf where part of the catch was taken and the larger shrimps screened out by hand and all fish, seaweed and dirt carefully picked out. The shrimps for the market were boiled before the rest of the catch, in the same way as were those to be dried except that less salt was used and they were not boiled quite so long. After boiling, the shrimps were spread on matting on the sorting room floor where they could cool and the surplus moisture evaporate. They were then placed in baskets and conveyed by power launch to San Francisco.

Three Species of Shrimps. Three species of shrimps are taken in San Francisco Bay. Fully 90 per cent of them are of one species, *Crago franciscorum*. The remaining 10 per cent is made up of the two species, *Crago nigricauda* and *Crago nigrimaculata*.

The shrimps drift back and forth along the bottom of the bay with the tides but have the power in some measure to select their environment, for in the winter time when the fresh water is entering the bay in larger quantities they move farther down the bay. In the summer when the blue sea water encroaches on the flats they move farther up toward the river mouths. They appear to go on the shallower flats when they are carrying their eggs. The smaller individuals are found mostly in shallow water and in the deeper and swifter water more large ones are found. They have a wide range, however, for they are found in the deepest water as well as the shallowest and can be found in water perfectly fresh as well as in pure sea water. Very little is known about their life history. Females may be found carrying eggs attached to

her swimmerets at all seasons of the year. From evidence that has been gathered it is certain that the eggs are carried at least two months on the outside of the body before they hatch and the life of the shrimp from the egg through one spawning time is not less than two years. They feed on minute animal and plant life at the bottom. They may at times feed near the surface for they can swim rather rapidly through the water, moving with the head first.

Character and Quantity of the Catch. The catch of one junk for one tide varied from ten hundred pounds to ten tons. An average day's catch for the boats using forty nets was six thousand pounds and for the boats using sixty nets, eight thousand pounds. The nets always contain young fish, the quantity varying from 10 per cent to 75 per cent of the entire catch. The boats using sixty nets each on the shallow flats on the west side of San Pablo Bay caught the greatest proportion of young fish. The reason for this is that most of the fish which enter San Francisco Bay enter for the purpose of spawning. Among these fish the valuable ones are the herring, smelt, striped bass, shad and salmon. Besides these the young of other valuable commercial species, such as the crab and the sole, enter the bay for the purpose of feeding and for protection. A bay with rivers entering it is always a nursery for young fish. Where there is an intermingling of fresh and salt water as in the upper San Francisco Bay there is a prodigal growth of small animal life, including shrimps and other species of small crustaceans. Upon this small life the young fishes feed. The young fish are there because the shrimps are there. A method of shrimp fishing such as that employed by the Chinese, which catches the young fish as readily as the shrimps and holds them until they are suffocated, is a serious menace to the whole fishing industry of the bay and its tributary rivers. Even if they caught only shrimps, there is a limit to the number which should be caught for they are the food of our more valuable fishes, but when the method of fishing takes the young fish themselves in vast quantities, as did the Chinese nets in upper San Francisco Bay, it should not be tolerated if we value the other fisheries, or if we value the shrimp itself, for there is every evidence that even the shrimps were being overfished. To appreciate the seriousness of the situation as it existed in 1910, just imagine the nineteen Chinese junks with their combined nets numbering one thousand, each one having a mouth opening of 24x4½ feet, straining the small fish and shrimps from the rushing water, tide after tide. The total annual catch by the Chinese junks at the time they were stopped from fishing in 1911 was considerably in excess of ten million pounds of fresh shrimps and fish combined. Of this amount no more than eight hundred thousand pounds of the shrimps were used fresh. The rest was all dried and marketed as dried shrimp meat and fertilizer.

After the Chinese method of fishing was stopped it was found that the Italian method as employed in the early days was not profitable, for the shrimps were too scarce and there were no more flounders or tomcod. Neither was the shrimp beam trawl profitable for the shrimps were not plentiful enough for that method and the nets were torn on the Chinese shrimp stakes driven all over the bay. As no other method of catching shrimps was employed and as the market was bare of shrimps, the

presence of which had been for years a feature of California, the ban was lifted from the Chinese nets in southern San Francisco Bay in 1915. The nets do less damage in that part of the bay as there are fewer young fish there of valuable varieties for the reason that there is little fresh water flowing in that portion of the bay. The young of the herring are not found there, as they spawn in the upper bay, nor are the young of the smelt, shad, striped bass or salmon found there, for they are hatched only in the larger rivers and as they descend to the bay they distribute themselves in the brackish water nursery of the upper or San Pablo Bay. Shrimps were not very plentiful in south San Francisco Bay on account of the former heavy fishing and on account of the gradually increasing salinity of the water. Drying of shrimps had also been prohibited and it was found not very profitable to fish for the fresh market only. During the first year after they resumed fishing the markets took less than 350,000 pounds of shrimps. They could have had more but there was not the former demand. The amount of

Fig. 5. Drying shrimps at Point San Pedro in 1910. Photographs by N. B. Scofield.

fresh shrimps marketed has increased each year until now the amount is equal to that of any former year when shrimp fishing was at its height. The shrimps have increased in numbers in all portions of the bays, as also have the number of small fish, especially the young of the striped bass. It has now become profitable to use the shrimp beam trawl which, towed with the tide, catches the shrimp with a very small per cent of young fish. As illustrative of the damage done by the Chinese nets in former years the following is quoted from my note book of 1897:

> "The average catch per day for each boat at the San Rafael (Point San Pedro) fishery, during the last two weeks of July, was seventy baskets, each basket weighing about ninety pounds, making in all six thousand three hundred pounds. The average number of boats out each day was seven, making in all a daily catch of forty-four thousand one hundred pounds. For thirteen days (the time they were under continual observation) this number is swelled

to six hundred sixty-one thousand, five hundred pounds. One-half of this catch consisted of small fish, the principal species being smelt, California anchovy and sculpin.

The small smelt, two and one-half to three and one-half inches long, were very abundant, making up over one-fourth of the entire catch. The estimated amount of these young smelt taken in the last fifteen days of July is 165,375 pounds, or about 16,537,500 small fish. When the nets are brought to the surface of the water, these small smelt are dead, so that to throw them back would do no good."

Later, in the year 1910, we made the following notes:

"*Oct. 25, 1910*: Visited two San Pedro Point boats as they lifted their nets. One had 30 per cent of young fish, mostly smelt and sole. They also had a good many undersized female edible crabs, which were alive, but they had not attempted to throw them back. The other boat had 20 per cent of young fish.

Oct. 28, 1910: Six boats out of San Pedro Point. Ming's boat had eighty baskets on this tide, of which 30 per cent was fish, mostly young smelt, young sole, and tomcod. One boat had forty baskets, two boats fifty baskets each, and the remaining two had seventy-five each. The amount of young fish was about 20 per cent. Ming says he uses forty nets and has averaged seventy baskets a day for September and October. The five camps above him use sixty nets each and their catch is much larger.

Oct. 29, 1910: Again visited San Pedro Point boats. Five boats out. The catch the same as yesterday. Three boat crews have been arrested in the last few days for catching young fish, but when visited yesterday and today they made no attempt whatever to throw back even the few fish that were alive. Wing had used a screen to get out the fish, but his catch was still 30 per cent fish. Their nets were all set wide open, as the tides are not so strong now."

The above notes are selected to give a conservative idea of what the average catch consists in upper San Francisco Bay. The greatest damage is done on the shallow San Pablo Bay flats. During the winter months large numbers of small striped bass are killed in the nets. The boats which fished below San Pablo Bay in the deeper water near Red Rock and the Stone Quarry caught smaller quantities of young fish than those above, but they caught more of the young striped bass than any others. The late increase in the number of striped bass is undoubtedly in large part due to the abolition of the Chinese nets in the upper bay, and if we value that fine food and game fish the destructive shrimp nets should be kept out.

The Chinese operating in South San Francisco Bay catch fewer young fish and the varieties caught are not of the valuable species. The lower bay can easily supply the fresh markets without serious injury to any of the other fisheries. But even there, the nets should be prohibited as soon as a less destructive method of shrimp fishing can be developed.

THE FISHES OF THE CROAKER FAMILY (SCIAENIDAE) OF CALIFORNIA.

By EDWIN CHAPIN STARKS, Stanford University.

The fishes of this family have a peculiar silvery skin that is unlike the bright, burnished silver of some fishes, the herrings for instance, but suggests rather frosted silver. The head is closely covered with scales, more or less irregular in size and shape, and the pore-bearing scales of the lateral line extend onto the caudal fin. The bones of the skull are variously excavated with tunnels and open channels (cavernous), and the chin is usually provided with large pores or barbels. Two dorsal fins are present; the first composed of spines and more or less triangular in shape. The anal fin has one or two spines, sometimes very small and slender or sometimes the second one is very much enlarged.

The croakers are carnivorous fishes rather distantly related to the basses. Many of them make a peculiar noise from which the common names of croaker, grunter, and drum have been derived. The noise is supposed to be made by forcing the air (or more properly, gas) from one part of the swim bladder to another. The species are numerous on sandy shores, and are most abundant in warm and tropic seas. At Panama, for instance, there are between 40 and 45 representatives of this family. Of the eight that occur on our coast only two are found in abundance as far north as San Francisco. Most of the others occasionally stray that far, but are common only on the southern coast. All of them are very good food fishes, and some are classed as game fishes.

The common or popular names of these fishes are even more mixed up and poorly applied than usual. *Cynoscion nobilis,* the "sea bass," is not a bass, and *Seriphus,* sometimes called the herring, does not even remotely resemble the herring. The young "sea bass' is known as "sea trout." No possible stretch of the imagination could make it suggest a trout, and having wrongly called its parent a bass, to call it a trout is a very good commentary on how loosely common names are used. *Genyonemus,* the fish that is usually known as the kingfish, is sometimes called "tomcod" on the southern California coast. It resembles a tomcod as little as *Seriphus,* the queenfish, resembles a herring. When *Genyonemus,* the kingfish, is called "tomcod" the name kingfish is transferred to *Seriphus,* the queenfish, or white croaker. *Cynoscion parvipinnis,* a close relative of the "sea bass," is sometimes called "bluefish," though it has nothing whatever in common with the famous bluefish of the Atlantic. The names croaker, roncador, and corvina are not at all consistently applied, but are shuffled back and forth between various of these fishes.

Hence in the use of vernacular names among these or any other fishes the reader is again cautioned that there is no constancy nor rule for their application, and he can only be sure of definitely indicating a given fish by using its scientific name. Though such names will probably never be used by people at large, and certainly not by unlettered fishermen, the scientific name is nevertheless the one true name for a species, and a name that will be recognized by scientific men in all countries the world over.

KEY TO THE FISHES OF THE CROAKER FAMILY IN CALIFORNIA.

1. Lower jaw projecting beyond tip of snout, which is sharp.
   2. Base of second dorsal fin about equal in length to base of anal fin. *Queenfish or White Croaker. Seriphus politus.* Page 15.

   2–2. Base of second dorsal fin very much longer than that of anal fin.
      3. Teeth at middle of upper jaw little if any enlarged. Pectoral fin more than half the length of head. Its tip reaching about as far back as tips of ventrals. *White Sea Bass. Cynoscion nobilis.* Page 15.

      3–3. One or two long teeth pointing backward at the middle of upper jaw. Pectoral fin less than half the length of head. Its tip not reaching as far back as tips of ventrals. *California Bluefish. Cynoscion parvipinnis.* Page 16.

1–1. Tip of snout blunt and projecting beyond tip of lower jaw.
   4. A single short barbel or appendage at tip of lower jaw.
      5. A large thick spine at front of anal fin. The first spine of the first dorsal not longer than the spines just behind it. The tip of the first dorsal rounded. *Yellowfin Croaker. Umbrina roncador.* Page 17.

      5–5. No enlarged spine at front of anal fin. The first dorsal spine longer than the others, making the tip of the first dorsal very sharp. *California Whiting. Menticirrhus undulatus.* Page 17.

   4–4. No single barbel at tip of lower jaw.
      6. A large thick spine at front of anal fin.
         7. A large black spot on front of pectoral fin. Pectoral fin as long as head, and reaching past tips of ventrals. Caudal fin concave behind. *Spotfin Croaker. Roncador stearnsi.* Page 18.

         7–7. No spot at front of pectoral, but a dark spot usually present on hind edge of gill cover. Pectoral fin much shorter than head and not reaching to tips of ventrals. Caudal fin not concave behind. *Black, or Chinese Croaker. Sciaena saturna.* Page 19.

      6–6. No enlarged spine at front of anal fin. *Kingfish. Genyonemus lineatus.* Page 20.

GLOSSARY.

Anal fin: The single fin on the lower side of the body towards the tail.

Barbel: A small fleshy projection or appendix. In these fishes it is on the lower jaw.

Caudal fin: The tail fin.

Dorsal fin: The fin on the back. In these fishes it is divided into two fins: the first composed of spines, and hence called spinous dorsal; the second composed of soft rays.

Maxillary: The flattened bone bordering the mouth above.

Pectoral fin: The pair of fins, one on each side, situated close behind the gill opening.

Preoperculum: A bone of the gill cover that borders the cheek behind. It is considerably in front of the hind edge of the gill cover, and has a free edge.

Snout: The part of the head that lies in front of the eyes except the lower jaw.

Ventral fins: The paired fins on the lower part of the breast; close under the pectorals in these fishes.

The Queenfish, or White Croaker (Seriphus politus).

The length of the base of the second dorsal fin is about equal in length to the base of the anal fin. The tip of the snout is rather sharp and the tip of the lower jaw projects beyond it when the mouth is closed. The mouth is long and narrow, and the maxillary does not quite reach to vertically below the hind border of the eye. The dorsal fins are well separated, and the spines of the first dorsal are slender. The color is bluish above with the sides and belly bright silvery, the fins yellow, and the base of the pectoral dusky.

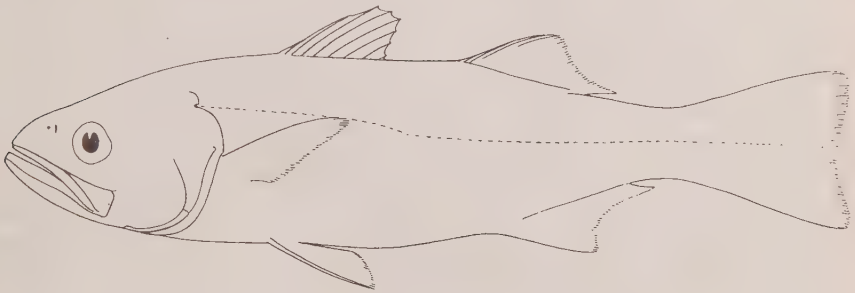

Fig. 6. The queenfish (*Seriphus politus*).

On the southern California coast this fish is ridiculously called herring, a name that should decidedly be discouraged, for it has nothing in common with the herring, is not related to it, and does not even look like it. It also in the same region shares with *Genyonemus lineatus,* the name of kingfish. The latter is almost universally so known and hence has the best right to the name.

This fish reaches a length of about a foot, and is an excellent pan-fish. It is salted and smoked to some extent in southern California and marketed as herring. It is common on sandy shores of the southern and Lower California coasts, and has been taken as far northward as San Francisco.

The White "Sea Bass" (Cynoscion nobilis).

The snout is sharp and the tip of the lower jaw projects beyond it when the mouth is closed, while the length of the base of the second dorsal is three or more times the length of the anal base. The length of the pectoral fin is more than half the length of the head, and the tip of the pectoral reaches about to opposite the tips of the ventrals. There are no greatly enlarged teeth pointing backwards at the front of the upper jaw. The mouth is large and the maxillary nearly or quite reaches to vertically below the hind border of the eye. The caudal fin

is concave behind. Very fine dark points are everywhere dusted over the silvery color, making it more or less dusky bluish. The inner surfaces of the pectoral and ventral fins are dusky.

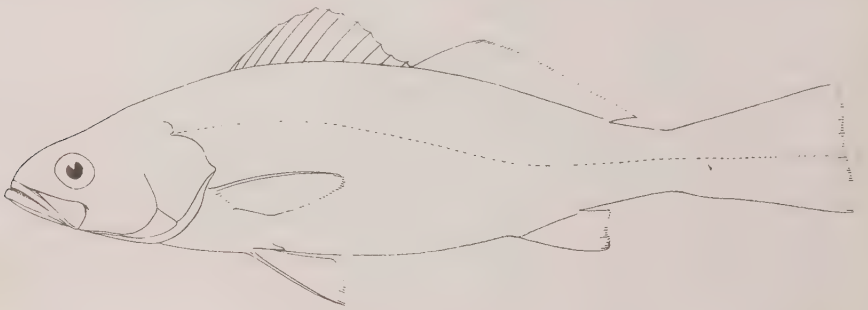

Fig. 7. The white sea bass (*Cynoscion nobilis*).

Though this fish is only distantly related to the bass, it is in California almost universally known as the sea bass or white sea bass. On the Atlantic coast fishes of this group are known as weakfishes. This species is one of our most valuable food fishes, reaching a weight of 90 or more pounds, and having firm white flesh. It is found in considerable abundance along the California coast and southward to Lower California. It has been reported as far north as Puget Sound. The young has dusky bands extending down from the back onto the sides. Fishermen call the small ones sea trout.

The California "Bluefish" (Cynoscion parvipinnis).

As in the white sea bass the snout is sharp; the tip of the lower jaw projects beyond it when the mouth is closed; and the base of the second dorsal fin is much longer than that of the anal fin. It may be known from the white sea bass by the pectoral fin being less than half the length

Fig. 8. The California bluefish (*Cynoscion parvipinnis*).

of the head, and its tip not nearly reaching as far back as the tips of the ventrals. It is also distinguished by having one or two long sharp teeth pointing backwards from the middle of the upper jaw. The dorsal fins are close together. The color is steel blue above and silvery on the lower parts and sides.

This fish closely resembles the white sea bass—in fact it is not recognized as different by many fishermen. It does not reach as large a size,

probably not exceeding a couple of feet in length, and it is said to be much inferior to it. Its flesh is soft and it does not bear transportation well. It is found from southern California southward along the coast of Lower California.

The name bluefish as applied to this species probably is on account of its color, and not because it is thought to be the same as the famous bluefish of the Atlantic. The latter is a very different fish, not at all related to this species.

The Yellowfin Croaker (Umbrina roncador).

This fish may be known from its relatives by a short fleshy barbel, or appendage, that projects from the chin, and, in addition, by a large thick spine at the front of the anal fin. The enlarged spine is the second anal spine, there being a very short one in front of it. Its snout is blunt and projects over and above the tip of the lower jaw. The mouth is nearly horizontal, and the maxillary reaches to under the middle of the eye. The edge of the bone that bounds the cheek behind

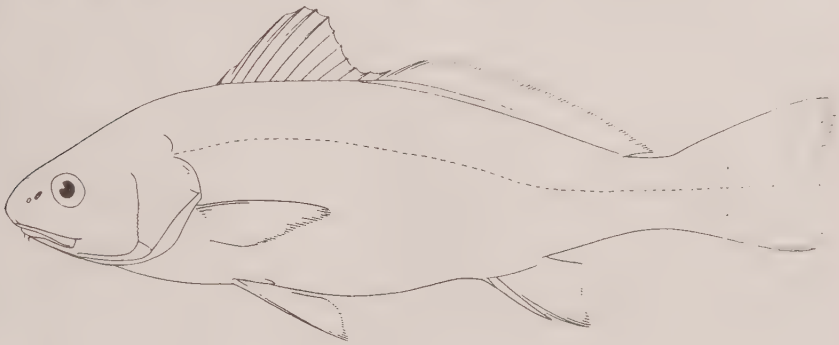

Fig. 9. The yellow-fin croaker (*Umbrina roncador*).

(preoperculum) is set with fine spines. The spinous dorsal is triangular in shape but rounded at its upper angle at the points of the first spines. The pectorals are rather short and do not reach as far back as the ventrals do. The caudal is concave behind; and the upper lobe is longer than the lower. Brassy and golden reflections overlie the silvery color. The back is bluish, and over the back and sides are many wavy dark lines that extend upward and backward following the rows of scales. The fins are mostly yellow.

This fish reaches a length of 15 or 16 inches, and it is rather common on the southern California coast. Its range extends southward into the Gulf of California while an occasional one strays northward as far as San Francisco. It is a very good food fish, and is caught in considerable abundance by the anglers on the piers and beaches of southern California. It is a very handsome fish when it is first drawn from the water, but its iridescent colors soon fade.

The California Whiting or Corvina (Menticirrhus undulatus).

This is a well marked fish that may be known by a fleshy barbel, or appendage, that projects from the chin, the first dorsal spine longer than

the others, making the fin sharply pointed above, and the caudal fin with its lower angle rounded and its upper sharp. The barbel at the chin is longer than in the yellowfin croaker. It may be known from that species at once by its lacking an enlarged spine at the front of the anal. The upper jaw projects considerably over the lower, the mouth is horizontal, and the maxillary barely, or scarcely, reaches to below the front edge of the pupil. The edge of the preoperculum is divided into fine points which are membranous and not bony spines as in the yellowfin croaker. The pectoral is rather long and reaches to about the tips of

Fig. 10. The California whiting (*Menticerrhus undulatus*).

the ventrals. The color is grayish with bright reflections. On the back and side are many dark wavy lines that run upwards and backwards. The back sometimes has faint dark bars crosswise to the body.

This fish is rather common on sandy shores of southern California, and is known southward into the Gulf of California, while individuals are sometimes taken as far northward as San Francisco. It is a very good food fish and reaches a length of 18 or 20 inches.

The Spot, or Spotfin Croaker (Roncador stearnsi).

This fish may be known at once by the large black spot at the base of the pectoral fin. It is not only on both sides of the pectoral, but is also somewhat on the body behind the pectoral base. As in most of the

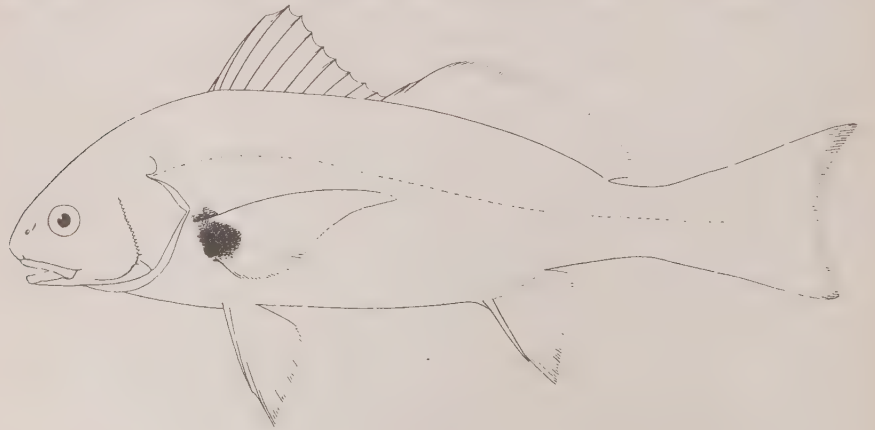

Fig. 11. The spot (*Roncador stearnsi*).

croakers, a blunt snout extends over a horizontal mouth. The mouth is moderate in size, and the maxillary reaches to below the middle of the eye. The preoperculum is set with fine sharp spines. The first dorsal has stout spines and the second spine of the anal is enlarged, the first spine being, as usual, small. The pectoral is as long as the head, and reaches considerably past the tips of the ventrals. The color is grayish silvery, lighter below. Wavy dark lines follow the rows of scales extending upwards and backwards. These are less conspicuous than in the yellowfin roncador. Two dusky streaks usually run back from the throat to the ventrals and thence to each side of the anal.

This fish is abundant on the southern California coast, and, like most of the others, has occasionally been taken as far north as San Francisco. It is of some importance as a food fish, and reaches a weight of 5 or 6 pounds.

The Black Croaker, or Chinese Croaker (Sciaena saturna).

The following combination of characters will identify this fish from its relatives: The snout blunt and projecting over the tip of the lower jaw; no barbel at the chin; the second anal spine large and thick; no

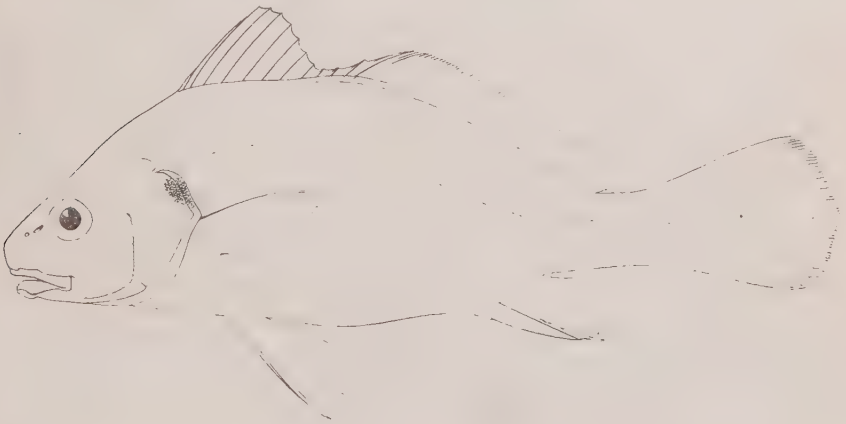

Fig. 12. The black croaker (*Sciæna saturna*).

black spot at base of pectoral; the pectoral shorter than the head and not reaching to the tips of the ventrals. The mouth is small, the lower jaw closes within the upper, and the maxillary reaches to below the middle of the eye. The scales on the head are small, rough and uneven. The preoperculum has a membranous edge that is divided into very fine points which are scarcely noticeable without the aid of a magnifier. The dorsal spines are rather stout, but not nearly so stout as the second anal spine. The caudal is slightly convex, or with its middle rays the longest. The color is dusky with reddish coppery reflections. A pale band usually extends downward from between the dorsals to opposite the tips of the ventrals. This often fades with age. The lower parts are silvery but dusted over and obscured by dark specks. The side of the head is more brilliantly coppery color than elsewhere. The ventral fins are dusky or black. A black spot is present at the edge of the gill cover just above its angle.

This fish has not been reported north of Santa Barbara. Its range extends southward alonge the coast of Lower California. It reaches a length of about 15 inches, and is a fairly good food fish.

The Kingfish (Genyonemus lineatus).

The characters of the first sentence separate this fish from its relatives. The blunt snout projecting over the tip of the lower jaw; no barbel at the chin; no enlarged spine at the front of the anal. The mouth is rather oblique. The lower jaw closes within the upper, and the maxillary reaches to under the middle of the eye or a trifle farther. The edge of the preoperculum is membranous and without fine bony points. On each side of the lower jaw just behind the chin are several very small barbels, so small that they scarcely show without the aid of a magnifier. The spines of the dorsal are slender. The pectoral ends opposite to the very slender points of the ventrals, or reaches a little past. The caudal fin is slightly concave behind. Brassy reflections

Fig. 13. The kingfish (*Genyonemus lineatus*).

overlie the bright silvery color. Very faint wavy lines follow the rows of scales upwards and backwards. The fins are usually yellowish, and there is a small dark spot just behind the base of the upper pectoral rays.

This fish and the white sea bass are the only ones of this family that are found in any abundance as far north as San Francisco. It runs southward along the Lower California coast. It is commoner in summer than in winter, and more abundant on the southern coast than the northern. It scarcely exceeds a foot in length, but its abundance makes it a food fish of considerable importance. When fresh it is a very good food fish, but its flesh is rather soft and it does not keep very well. It is sometimes called tomcod in southern California. This name should not be used, for it in no way, shape, nor manner resembles the tomcod

NOTE ON THE SAND DAB.

By EDWIN C. STARKS.

Through an oversight in the paper on flat-fishes that appeared in the last number of CALIFORNIA FISH AND GAME the old name of soft flounder was used as a common name of the fish that has in recent years been known as the sand dab (*Citharichthys sordidus*). This name, sand dab, has almost entirely supplanted the older name on our coast and for that reason should be used. It is, however, one of those unfortunate names borrowed from another fish from another part of the world. The sand dab of the Atlantic coast (*Hippoglossoides platessoides*) has the best right to the name, for it was first so called. It bears little resemblance to our sand dab. So in your copy of CALIFORNIA FISH AND GAME please write sand dab in place of soft flounder.

THE STICKLEBACK: A FISH EMINENTLY FITTED BY NATURE AS A MOSQUITO DESTROYER.

By CARL L. HUBBS.

Since it has been proved that malaria, yellow fever, and other dread diseases are carried by mosquitoes, there has developed a wide interest in these little insects, which hitherto had been regarded more as a nuisance than as a menace. Many studies have been undertaken in order to determine the best methods by which mosquitoes may be exterminated or at least greatly reduced in numbers.

The use of window screens, the draining of swamps, and the oiling of waters, as well as the spread of natural enemies, are methods of control that have received attention with very notable success. For instance, the building of the Panama Canal has been made possible by the destruction of mosquitoes and the consequent control of yellow fever.

A word as to the main methods of mosquito control. The use of screens does not eliminate the evil. The draining of swamps has been very successfully practiced in New Jersey, and is applicable to other regions where large, swampy tracts occur. The use of oil, which spreads as a film over the water, forms a sufficient control, but requires continued attention and expense, and can scarcely be applied to most ornamental ponds or reservoirs or to pools from which animals drink.

There is thus need for other methods, and of these the spread of the natural enemies of the mosquitoes is by far the most important. These natural enemies are numerous, and the most valuable of them all for the purpose are fishes, which destroy the young stages of the mosquitoes as well as the adults when they alight on the surface of the water.

Among the fishes extensively used in mosquito control, the little killifishes or topminnows may be mentioned, but there are others which can be strongly recommended. This short report is written to call further attention to the value of the stickleback (*Gasterosteus*) as a mosquito destroyer in California, particularly in the coastal regions.

FACTORS RENDERING THE STICKLEBACK AN EFFICIENT MOSQUITO DESTROYER.

1. *The stickleback uses mosquitoes as food.* This point is to be proved first of all. The evidence is convincing. The stickleback has been seen snapping up adult mosquitoes thrown into the water. Mosquitoes are unable to breed in waters inhabited by sticklebacks. This conclusion, previously arrived at in regard to the stickleback and the salt-marsh mosquito of San Francisco Bay, has been rigidly tested out in many of the streams from San Francisco south to the Mexican border. Only a few examples from the observations can be made here.

In San Francisquito Creek, near Palo Alto, pools were repeatedly found near one another and apparently similar except in this respect: in the one pool sticklebacks were plentiful, but no mosquito wrigglers could be detected, while in the other pool sticklebacks were absent, while mosquitoes were breeding in abundance.

The swamps, pools and streams of the coast region of San Luis Obispo and Santa Barbara counties appear as ideal breeding waters for mosquitoes, yet the people there enjoy unusual freedom from these pests and dangers. A study of the region makes it almost certain that these people have the stickleback to thank for the service thus rendered. But, even in these regions mosquitoes breed in abundance in the mountain canyons into which the sticklebacks can not penetrate because of the steep descent of the bouldery stream beds. The mosquitoes are forced back, however, into the mountains where there are fewer people for them to torment.

In Mission Valley in San Diego sticklebacks are, for some unknown reason, entirely absent, but mosquitoes and gnats are very troublesome during the summer months. From the valley the mosquitoes are blown up the canyons to the city on the mesa above. During the summer the surface waters of the San Diego River, which flows through Mission Valley, are reduced to a series of pools. In these pools three introduced fishes, the golden bream (*Notemigonus crysoleucas*), the bullhead (*Ameiurus nebulosus*), and the green sunfish (*Lepomis cyanellus*) are generally abundant. It seems that the stickleback is more efficient in the control of mosquitoes than are these three other fishes together.

During an entire summer's study of this problem, I never noted a considerable number of either mosquito wrigglers or sticklebacks in the same pool together. Wherever the stickleback can penetrate, and they go as far as they can, the mosquitoes are effectively destroyed.

2. *Abundance of other food will not deter the stickleback from feeding on the mosquito wrigglers.* This conclusion is evident from field observations, and is confirmed by the size and structure of the fish: its mouth, small even for such tiny fishes, will not permit it to feed on large insect larvæ such as those of dragon flies, which, by the way, upon emerging as the adult insect, feed upon the mosquitoes in the air.

3. *The stickleback feeds at all levels of the water, from bottom to surface.* Because of this fact, mosquito wrigglers of different habits are all picked up. Statements published by Seal, and by Lutz and Chambers for the stickleback of the East Coast, make it appear a bottom feeder. At least, such a conclusion does not apply to the stickleback of

California. I have thrown mosquitoes into a pool of the Los Angeles River, and scarcely would one of them drop below the surface before one of these little fishes would dart from some hidden corner and devour it.

4. *The habits of the stickleback render it destructive to mosquitoes.* This little fish hangs at any level of the water, tail bent to one side or the other, passively waiting for a stimulus to move. The wriggler is spied, and the stickleback snaps it up with pike-like speed and voracity.

5. *The stickleback itself is largely immune to the attacks of larger fishes.* This is a fact of much importance, giving the little spiny and armored stickleback a distinct advantage in many waters over other mosquito-eating fishes, as the topminnows. Sticklebacks live abundantly with rainbow trout, as in the Ventura River; and with black bass, as in the San Luis Creek. In ponds and reservoirs the waters could thus be stocked with both game fishes and sticklebacks, whereas the topminnows would, under such circumstances, soon be devoured.

6. *The stickleback is a widely distributed fish.* This little fish (*Gasterosteus aculeatus*), of several varieties, is found along the shores of all northern regions in the brackish waters of the bays and estuaries, and in the coastal streams. The stickleback in the streams of California extend their ranges from the estuaries as far up into the mountain canyons as they can penetrate. At high water they spread out and are trapped in many little pools from which mosquitoes are thus eliminated.

7. *The stickleback lives and breeds in small pools.* These pools include not only those along stream sides, but also the little shallow ponds and reservoirs about houses, which if not stocked with fishes, become breeding grounds for mosquitoes. For this purpose the stickleback is eminently fitted by its size, structure and habits. After planting once it requires no further care. Observations in California have led to these conclusions.

8. *The rise in temperature during the summer months seems not to kill the sticklebacks.* Where other fishes might be killed off in summer in shallow ponds and reservoirs, the sticklebacks seem to live on. These little fishes have even been found in the hot springs of Tia Juana, near the Mexican boundary.

9. *The abundance of sticklebacks in the streams of California provides an ample supply of these fishes for the stocking of artificial and natural pools, ponds and reservoirs.* A fine meshed minnow seine, or one made of from four to six yards of cheap cloth, can be used to obtain these fishes in the waters in which they live.

10. *The stickleback is a hardy little fish and will stand transportation from its native streams to artificial ponds, in open buckets or in cans, such as those used to transport fish fry for planting in streams distant from the hatcheries.*

PRACTICAL USE OF THE STICKLEBACK IN THE CONTROL OF MOSQUITOES.

No artificial cistern, pool, pond or reservoir should be left unstocked with fishes, and for this purpose the stickleback is probably the most practical fish in California, for the reasons which have already been outlined. By its use the breeding of mosquitoes about houses would

be prevented, and a troublesome nuisance and a real source of danger would be largely eliminated, for the mosquitoes which attack us have mostly been bred close by.

There would remain, however, many isolated pools in the salt marshes, along the sides of the lower courses of the streams, and in their upper canyons. These pools are usually without fishes, and in some of them dangerous mosquitoes breed in abundance. The stocking of these pools with sticklebacks would doubtless, in many cases at least, prove both possible and advisable. This might be done independently by those people interested in their own welfare, or perhaps better by some public official. It is quite probable that in the swampy lands and in the rice fields along the Sacramento River, the little topminnows would prove more efficient enemies of the malaria mosquitoes than the sticklebacks. The California Fish and Game Commission is working with that idea in view.

The control of mosquitoes is quite possible, in part by the use of the stickleback, as advocated in this article, and in part by other methods, such as the draining of swamps, etc. It is to be hoped that the proper authorities in California will increase their energy in this field, for the effective control of mosquitoes within its borders would make California an even safer and more pleasant place in which to live than it is now.

EARLY STAGES OF THE SPINY LOBSTER TAKEN BY THE BOAT "ALBACORE."*

By WALDO L. SCHMITT, United States National Museum.

The investigations of the Fish and Game Commission boat, the "Albacore," have recently yielded some valuable returns, during her scientific investigations of the commercial fishes and fisheries of southern California, in the shape of hitherto unknown larval stages of the California spiny lobster (*Panulirus interruptus*).

Under the auspices of the United States Bureau of Fisheries and through the courtesy of the Scripps Institution the writer recently spent some months in California primarily for the purpose of making a study of the Scripps Institution's extensive series of plankton samples in the hopes of shedding some light on the life history of the spiny lobster. Though in considerable number, only the earlier larval stages were represented in their collections.†

*Mr. Waldo L. Schmitt of the United States National Museum, has made a special study of marine crustacea, and the opportunity to provide him with material for the study of the early stages of the spiny lobster was a very welcome one to the Fish and Game Commission. His visit to this coast came at a time when the scientific work of the "Albacore" was but fairly under way, and the fact that it was able to provide him with material which seems to be of very considerable value should be of happy portent for the future. The superintendence of the hauls and of the handling of the nets was very competently done by Mr. Elmer Higgins, attached to the "Albacore" as a scientific assistant during her work on larval fish.

It will be well to call attention to the significance of the wide distribution of the larval lobsters. These flat, transparent organisms are found floating freely in the water, and are distributed by the currents. Although we do not know, of course, what proportion of the larvæ are carried along the coast by the currents, nor what numbers of them finally succeed in obtaining a suitable footing on the completion of their development, yet it should be fairly clear that there is an interdependence between widely separated regions inhabited by the spiny lobster.—*Will F. Thompson.*

†Subsequent to the taking of the large phyllosomes referred to below, one of like size was found in the Scripps Institution collections. It is interesting to note in this connection that in one of their large aquarium tanks they succeeded in hatching out the first phyllosome stage this past summer from the eggs carried by a single berried female.

But on August 29, 1918, while the writer was aboard the "Albacore," four phyllosomes of large size, the largest ever taken off California, were secured with the vessel's small otter-trawl. These specimens average about an inch in length, of body proper, and were obtained about 16 miles west of the Coronados Islands in 75 fathoms of water. One of these specimens is shown in the accompanying figure (fig. 14).

Including the above-mentioned specimens, the "Albacore" had taken, up to the time of the writer's return from California, some fourteen lots of large and intermediate sized phyllosomes, and another rare stage

Fig. 14. Large phyllosome, an heretofore undiscovered larval form of the spiny lobster.

known as the puerulus. Some of these lots contained numerous individuals. The puerulus is the stage intermediate between the pyhllosome, the form in which the "lobster" is hatched from the egg, and the definitive form of the adult. These collections were well distributed through the southern California waters ranging as far as 150 miles off shore and to a maximum depth of 75 fathoms. This is a rather surprising range for such a well known littoral form.

So far as a preliminary examination of the material taken by the "Albacore" together with that obtained from the Scripps Institution goes, it appears that the early life history of the California spiny lobster is in a fair way of solution. A full report of the results of the summer's work is in preparation.

THE COYOTE AS A DEER KILLER.

By E. V. JOTTER.

Although we have long known the coyote as a predatory animal it has only been recently that we have obtained evidence of its destructiveness to big game. Heretofore known as a destroyer of quail, grouse and domestic stock such as pigs, sheep and poultry, the coyote must now be classified along with the mountain lion as a deer slayer.

In that many persons have been slow to believe that the coyote is a factor in our deer supply we have attempted to gather some evidence tending to prove that this animal is responsible for a considerable loss each year in Trinity County. This evidence is presented herewith.

Fig. 15. Male coyote taken in trap January 31, 1918, 14 miles south of Douglas, Trinity County, California, by C. O. Fisher. The stomach contained deer hair and meat. Photograph by C. O. Fisher.

Bert Higgins, who runs a trap line within the Trinity Game Refuge, reports finding along this one line during one month, the remains of fifteen deer killed by coyotes. Ranger Bucklew in April, 1916, saw a full grown doe, apparently in good condition, pulled down by one coyote.

Mr. Wm. Friend writes as follows concerning his experience with coyotes in the Game Refuge:

"In regard to the deer I found killed by coyotes in the Game Refuge, will say I commenced trapping between Little Creek and Bear Creek on February 1, 1916, and between that date and March 2, 1916, I found the remains of seventeen deer killed by coyotes.

They were all sizes from large bucks to fawns, but mostly small deer. The snow was about two feet deep and the deer had collected near the river and in gulches. After the snow settled the coyotes could run on top, but the deer broke through, so it was an easy matter for the coyote to catch them. In one gulch I came down I found eight deer that had been killed at different times—one of them had been killed

recently and none of them were over ten days. In many other sheltered places I found remains. In one instance about Feb. 1, T. H. Campbell and I were riding along the road near Philip Habor's place and saw where coyotes had just killed a spike buck and were enjoying a feast when we frightened them away. I also have a large pair of antlers I brought home from one of their victims. It is not only when the snow is on, but in the spring when the deer are weak, and poor, that they destroy a great many. I was coming home from my traps after the snow had gone and not half a mile from the Van Matre place I saw two coyotes that had a large buck run down and would have killed him if I had not happened along at that time. The deer was not able to get up the bank then."

Ranger Gray's report on the coyote is given in full:

"I would like to emphasize the necessity for a state-wide campaign against the coyote and other predatory animals, in which all the people of the state are to a certain extent interested and would help to bear the expenses of such work. It goes without question that a great public benefit would be derived in ridding the country of coyotes, either by increased bounties or by other means that would encourage more trapping. It seems that an increased bounty would be the most effective means of encouraging trapping, and in obtaining the desired result. I have conversed with a great many stockmen and local people during the season with a view to getting actual cases where the coyote has been observed killing game or stock. The result is, few people have been found that have actually seen the coyote killing either wild game or domestic stock; however, they know beyond any question of a doubt that he is responsible for certain large losses in both cases. There is one good reason among others why he is not more often detected in the actual work of killing, for his wandering and search for food is generally done in the hours of the night. In his wild nature he very carefully shuns man, usually selecting the most secluded places in which to carry out his destructive work. Earl Moore, T. Flournoy and other men who have been handling sheep for many years in these mountains advise me that they never saw a coyote actually kill a sheep. However, they state that they have seen them driving and worrying the sheep and upon following the trail they invariably found dead sheep scattered along the route. The greatest losses among this class of stock from the source mentioned is to small bunches separated on the range from the main bands, and left on the range during the night unprotected. W. H. Atkeson of Hoaglin advises me that he saw a coyote kill two small pigs near his ranch house. Many others disappeared in only a few days in the same locality.

Fred Becker, who resides on Pilot Creek, states that he saw four or five coyotes chasing a small deer. He did not know whether the deer was killed. Ben. B. Iliff of this place tells me that during the past winter a blood trail was noted crossing the road near his ranch house. The tracks of a deer were impressed in the snow together with small tracks that resembled those of small dogs. The trail was followed and Mr. Iliff asserts that in a short distance he found the carcass of a large deer and upon his approach two coyotes scampered away. C. W. Vann of this place cites an instance where he saw a coyote catch and kill a quail. Mr. Vann states that while hunting he approached a clump of low brush (poison oak) and flushed a bunch of quail. The quail in leaving the brush were quite close to the ground and he very clearly saw a coyote jump and take one of the birds as it passed very near him. I have found only a few other cases similar to these already mentioned."

Mr. W. T. Shock of Hayfork writes this letter:

"In reading over the weekly Trinity Journal I noticed the letter from W. O. Friend in regard to coyotes and as the Forest requests any good evidence against coyotes I submit the following: As I have trapped and hunted the coyote all my life, I will write a little of my experience. I find that the coyote is very destructive to many kinds of game of this county, not only deer, but all kinds of birds, such as grouse and quail, the nests of which it robs. A coyote can catch plenty of deer when there is no snow, but it destroys more when the snow is deep. Many deer that are found along the rivers are killed in this way. When the heavy snow comes, the deer gather along the rivers and low ground, as the snow is less there. When coyotes get hungry they take after a deer, and if they catch it before it gets to the river they kill it, but if the deer makes into the water, the coyote goes after another one. The coyote will not go into the water, but the deer that run into the water are

so hot and weak that they freeze to death before venturing out again. I have seen coyotes after deer, and running the coyotes away, I have tried to make the deer get out of the water and could not until I helped them out almost dead, and some have died while I was taking them out of the water. I trapped on the Hayfork Creek above the Game Refuge and near Mr. Dockery's place on Carr Creek last winter and a number of deer were gathered at Mr. Dockery's lower barn eating hay with his cattle. Between the first day of January and the twenty-seventh of February I found the remains of twenty deer, either killed by coyotes or run into the creek and killed, and I caught eleven coyotes."

Mr. Edward Shock, who lives within the Hayfork township and within a few miles of the town of Hayfork, upon his own ranch property, called at our office and made some statements concerning the damage done by the coyote, for which he personally vouches. He states that last summer, he does not remember the exact date, while he was working in his garden he heard a noise on the side hill adjoining the garden plot, and upon glancing up, saw a fawn coming down the hill and it ran into his wire fence three or four times before it managed to get through. Closely pursuing the fawn were two coyotes. Shortly after they got in sight they saw Mr. Shock, stopped, then turned and went back into the bushes. The fawn came into the field and quite close to Mr. Shock, then saw him, became frightened, turned and went back through the fence and up the hill in about the same direction the coyotes had taken. The coyotes no doubt later caught the fawn, since they would merely hide away in the bushes for a little while when interrupted in a pursuit of this kind, then take the track and follow on.

Another instance of Mr. Shock's observation was during this fall while setting a coyote trap. He set his rifle down a few feet from him and in finding a place to drive the stakes to hold the trap he had moved a few feet away from the rifle. While busily engaged he heard a noise and looking around saw a young deer without horns, presumably a doe, come running along closely followed by two coyotes, one of which caught the deer while yet in sight of him. Mr. Shock quickly went for his rifle, but when he got it the coyotes had taken alarm and had left the deer. Its tongue was hanging out and it seemed to be just about run down, but it of course went on out of sight. Mr. Shock is firm in his belief, based on his experience, that in such instances the coyotes were merely interrupted and would take the trail again and no doubt catch the deer.

He trapped nine coyotes within two weeks around his place and states that in opening up some of them to see what the contents of the stomachs were he found that they were largely composed of venison, there being evidence in meat, bones and hair. He also states that the coyotes he has caught were all very fat. Mr. Shock says that the reason for his trapping activity was on account of the coyotes catching the chickens. He has found it impossible to raise pigs unless they are well penned. Mr. Shock is a far better trapper than the average settler and has some methods of trapping that seem to get better results than the ordinary trapper. He says, however, that the coyote is a very difficult animal to trap and that he has found that he gets him more through his curiosity than any actual desire for food. Mr. Shock's experiences concerning the coyote are not at all unusual and could be duplicated by a great many of the settlers throughout the Trinity Forest.

These are specific, authenticated facts, which could be repeated by every man who has his eyes open. It really is not surprising that the attitude of mind expressed by the following exists. "Why shouldn't I have a deer," the settler says, "which will be eaten anyway by the coyotes; especially when I have killed one or more coyotes myself." Or, as the trapper would say, "Why can't I get a deer, or three or four, during a year? Even if I kill only one panther or trap only six coyotes, I have done more to protect and to increase the deer than any other person or organization has done."

Two important factors in the reduction of a game species are predatory animals and the hunter. We attempt to compensate for loss by the second factor by closing the season for a period of years to allow recuperation. Why could not similar results be obtained by reducing the toll taken by predatory animals? Although it is true that a certain balance is established between a species of game and its enemies when left to nature alone, it has been frequently demonstrated that man can alter such a balance very much to the advantage of the species that has been preyed upon.

Residents of Trinity County are agreed that by far the most pressing need in efficient game protection lies in the control of predatory animals. The liberal bounty on the mountain lion has eliminated this animal as a serious menace, but the coyote still remains abundant enough to be an important factor in conservation. An increase in deer, quail and grouse can best be effected by a vigorous campaign against the coyote and other predatory animals preying upon them.

CALIFORNIA FISH AND GAME

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All material for publication should be sent to H. C. Bryant, Museum of Vertebrate Zoology, Berkeley, Cal.

February 3, 1919.

"Game laws are not passed with the idea of furnishing sport for a limited number of people, but to protect useful birds and animals for the benefit of the people as a whole."

THE 1916-1918 BIENNIAL.

Although due to war economy the 1916-18 biennial report of the Board of Fish and Game Commissioners is not so large or so attractively colored as the last report, it, nevertheless, contains some interesting facts regarding the activities, receipts, and disbursements of the commission during the past biennial period.

Outstanding features of the work of the past two years have been the erection of a splendid new fish hatchery in Inyo County, the building of a new patrol boat to be used in enforcing the laws in southern California waters and in the carrying on of fishery investigations, the enlargement of the activities of the commercial fishery department, including the administration of the kelp industry, an extensive educational and publicity campaign and the splendid results obtained in enforcing fish and game laws.

New laws enacted by the 1917 legislature have proved valuable. The Supreme Court decisions sustaining the state law prohibiting parcel post shipments of game has effectively stopped a much-used method of evading fish and game laws. The spiked-buck law continues to contribute much toward the conservation of deer, and at the same time has reduced the number of hunting accidents. Seventeen new game refuges created in 1917, comprising a total of 839,180 acres, have been well received by the public and are serving as safe breeding places for game.

The output of the fish hatcheries has been very gratifying, reaching a total of 25,697,420 in 1917 and 36,425,898 in 1916. A 16 per cent increase in the number of trout fry reared has been attained.

Scientific investigations of the fisheries have been undertaken and already valuable light on the habits and life history of the albacore have been obtained. The educational and publicity work of the commission is being well received by the public.

The principal recommendation for new legislation has reference to discretionary powers. Such legislation enabling the commission to close seasons, reduce bag limits, prohibit certain kinds of fishing apparatus, and in general take such immediate steps as will in their opinion afford prompt and effective relief and save from destruction by human hand that part of the wild life which has survived the adversity of nature, is pointed out as the greatest need.

Only a small edition of the biennial has been printed and it will be available only to those sufficiently interested to write to the commission for it.

FISH AND GAME COMMISSION NEEDS PLENARY POWERS.

The most important piece of fish and game legislation which the legislature will be called upon to enact this spring will pertain to the granting of plenary powers to the Fish and Game Commission. The need for this legislation has already been pointed out in these pages. The commission is not seeking more power, but simply a chance to make regulations which will allow better administration of the state's wild life resources. It should be clearly understood that regulations can not be enforced at will by the commission, but only after a hearing has been held and the regulations signed by the governor. The proper administration of the Migratory Bird Treaty Act is dependent upon regulations issued by the Department of Agriculture under authority granted it by Congress. To make the administration of state laws efficient, similar powers should be granted the commission managing the fish and game resources.

CALIFORNIA LAWS WILL BE MODIFIED TO AGREE WITH FEDERAL GAME LAWS.

California was one of the first states to make the game laws conform with those enacted by the federal government and the state has persistently upheld the Federal Migratory Bird Law. It is to be expected, therefore, that at the next legislature the few laws which do not conform with the new Migratory Bird Treaty Act will be modified. The state law still allows hunting one hour before sunrise and one hour after sunset. To agree with the federal law this section of the code will have to be modified so as to prohibit all hunting except between sunrise and sunset of each calendar day. The limit law on geese will have to be changed and the dove season made to begin on September 1. In the few cases where the California laws are more stringent than those of the federal government no change will be made.

VIOLATORS MAKE QUEER DEFENSE.

After some chronic violator of the game laws has been apprehended and a quantity of dried venison confiscated the usual plea is that the confiscated meat is bear meat or goat meat. The bones can be identified or the meat tested to prove that it is venison so that this plea as a rule is of little avail.

The same sort of defense has been offered by a violator recently arrested in Tulare County for having in possession the skin of a mountain sheep. This defendant at first maintained that the sheep was not a true wild sheep and later claimed that he killed the animal in self-defense. It will be an easy matter to prove at the trial that the skin held in possession was that of a wild mountain sheep and the violator will undoubtedly be heavily fined.

Fig. 16. Transporting fish to Salmon Creek in Monterey County. Although packed for ten miles on horses, the fish arrived in excellent condition.

MONTEREY STREAMS STOCKED.

Through the efforts of Senator E. S. Rigdon, Salmon Creek in southern Monterey County has been successfully stocked with trout. Although this stream is by nature a splendid trout stream, a large waterfall one mile from the mouth of the creek has made the upper reaches of the stream barren of fish life. It was with difficulty that 18,000 rainbow and steelhead trout recently planted in the stream were transported from the railroad. A fifty-mile haul with auto trucks from San Luis Obispo to Sanco Pojo Creek and then a ten-mile transport by horseback was necessary. The trip was

accomplished, however, without any appreciable loss in the fish. One variety of trout was placed in one branch of the creek and another in the other branch, about ten miles in all being stocked. From all reports the fish are doing well.

DUCK DISEASE AGAIN APPEARS.

During October, duck disease appeared in the Marysville Butte section of the Sacramento Valley. Hitherto, the disease has been restricted to the vicinity of alkaline lakes in the southern part of the San Joaquin Valley. Many hunters hunting near Colusa and Maxwell on the opening day of the season threw away their ducks after they had discovered many sick and dying birds about some of the ponds. The fact that an epidemic of anthrax had been prevalent in the same vicinity led many persons to believe that the ducks had contracted the same disease. This, however, seems very unlikely in that all birds under artificial conditions are largely immune to the disease, and it is not to be expected that birds of any kind would contract the disease under natural conditions. Sick birds secured showed every symptom of "duck sickness," a disease which is now well known through the investigations of the United States Biological Survey. Mr. Alexander Wetmore, assistant biologist, describes the symptoms as follows (The Duck Sickness in Utah. U. S. Dept. Agric. Bull., 672): 1. Paralysis of nerve centers controlling the muscular system (birds affected are able to support themselves in the air for short distances only or have the wings entirely helpless); 2, respiration is difficult and spasmodic; 3, pulse abnormal when bird is excited and in severe cases is weak and irregular; 4, nictitating membrane of eye reacts slowly (a test of the activity of this membrane is an important symptom); 5, eyes usually swollen and a discharge is noticeable; 6, alimentary tract practically empty, intestines shrunken, firm and much reddened; 7, excreta loose and watery, more or less greenish and voided at frequent intervals; 8, birds appear drowsy and lethargic though alert at the approach of danger.

By November 1 the epidemic had subsided and no more sick ducks were to be seen. The number of birds which fell victims to the disease is estimated at 5,000.

FEDERAL PERMITS.

The Migratory Bird Treaty Act provides for the issuance of scientific collectors' permits to all those interested in collecting either specimens or eggs, and also to breeders who desire to breed migratory or insectivorous birds. Permits to collect specimens are issued to properly accredited persons only and are required in addition to those issued under state laws. Applications for federal permits can be obtained when applying for a new state permit.

FISH COOKERY DEMONSTRATIONS.

For the purpose of stimulating the utilization of fish products, the United States Bureau of Fisheries has been conducting a series of demonstrations in fish cookery. Demonstrations have been held in San Francisco, Oakland, Berkeley, and Alameda, about 40 in all, with an average attendance of more than 100 women at each class. Mrs. Evelene Spencer and Mr. H. L. Kelly have been in charge. These demonstrations are made of practical value by securing the little-used and low-priced fishes, preparing and cooking them in front of the class, explaining every detail, and then serving each one present with a portion to taste. Even minute details of the proper way to skin a fish, remove the backbone, and slice it are shown. With the class watching, it is prepared for the oven, cooked and served.

Mrs. Spencer recommends the discarding of the frying pan, in favor of the hot oven method of cooking. Advantages are found in the elimination of unpleasant odors, the use of less than half the amount of fat usually required, and greater ease for both the cook and the one who has the serving of the fish. This is the method she uses in doing the work herself, and all who eat the cooked fish agree that it far excels in flavor the same kind of fish fried in the old-fashioned way.

The making of salads, both from freshly steamed fish, or from left-over fish is explained as is also the making of souffles, creamed dishes and imitation

chops. Soups, which for flavor are the equal of any which can be made from meats or oysters, are made from the heads and trimmings ordinarily considered as being only fit for the garbage can.

Thirty-four varieties of fish, not including salmon and halibut, have been used in the demonstrations. Thus, it has been shown that a housewife can cook fish any day in the month, if she wishes, and not have the same kind twice. Of these, the most popular were small sole, skate, sablefish, mackerel, kingfish, yellowtail, shark, shad, rockcod and salmon milts. The price of these fish ranges from 5 to 15 cents per pound, and many hundreds of women were surprised to find a number of them they preferred to even salmon or halibut, which cost from 25 to 40 cents per pound.

Needless to say, these demonstrations have proved very popular with housewives, and have added materially in increasing the demand for flounder, shark, skate, squid, sablefish and other low-priced fishery products of the California markets.

INCREASED CONSUMPTION OF FISH NECESSARY.

Increasing the consumption of fish is far more urgent today than during war times. There is now no submarine menace; there are more ships and there are 200,000,000 people who must be fed if they are to be saved from starvation. Every ton of nonperishable goods possible must be sent to Europe. The use of fresh fish releases easily-shipped meat products for exportation.

There is absolutely no limit to the amount of fish which is now waiting in the ocean, and more are growing to supply our needs. The people of California have responded to every call made on them thus far, and we urge that they continue to show their patriotism and humanitarianism, by a still greater use of fresh fish.

NOTES ON THE NEW GAME REFUGES.

The following notes relative to the recently-formed game refuges have been culled from forest officers' reports for 1917. Apparently, the new refuges are filling the place for which they were set aside.

All refuges in California are created under the districting act and so must be designated as a "fish and game district." Each refuge is lettered with the number of the main game districts of the state in which the refuge is situated prefixed to it.

Fish and Game District 1-A, located in the Klamath National Forest, is admirably situated for the purpose for which it was withdrawn, being a natural breeding ground. It covers an area of about one township and varies in elevation from about 1,700 feet at the Klamath River to about 7,000 feet at the highest point, thus giving both winter and summer feeding ground. The general exposure of the entire area is southwestern, which makes it the very best from a climatic standpoint. There is also one of the largest salt licks known near the center of this refuge.

When the refuge was first created there was much opposition to it, but lately the sentiment has been more favorable.

Fish and Game Districts 1-B and 1-C in Modoc County are ideal breeding places for game and there is absolutely no doubt as to the wisdom of the move in having these areas set aside. The people, as a whole, are strongly in favor of them.

Fish and Game Districts 1-I and 1-J, in the Tahoe and El Dorado National Forests, have not been in existence long enough to note any change in game conditions. While the people most affected accept the establishment of the districts as a matter of law, some criticism is voiced relative to the location. Why was it not located "somewhere else" is the usual comment. This attitude will gradually disappear after a time if the districts receive proper administration.

The people all seem to think that the Chimney Meadow Refuge (Fish and Game District 1-L) will be of great value to the deer as it is the wintering grounds for all the deer in the Cannell Meadow District. Thos. Smith and John Johnson claim that they counted 75 deer in one band last spring in Long Valley, which is a part of this new refuge. There are a great number of hunters from Los Angeles and the Mojave Desert that hunt in this proposed refuge, and it will require a regular paid game warden in that vicinity to properly administer the refuge.

Fish and Game District 2-A covers a fine piece of deer country, having both summer and winter range. The establishment of the refuge was very well received by the public, and it is believed that very little hunting has been done within its boundaries. Considerable complaint was made by hunters and others, because the boundaries of the refuge were not posted. This should surely be done before the opening of the next hunting season.

The people are in favor of Fish and Game Districts 4-A and 4-B, comprising

600,000 acres within the Angeles National Forest. Deer are becoming more and more plentiful. If anyone is benefited by reason of an open season, it is the resort owners, and yet with the possible exception of one owner, a man who has been in court several times for alleged game violations, I have yet to find a resort owner who is not in favor of the continuance of the game refuges.

When Fish and Game District 4-C was first formed the sentiment against it was very strong. This has changed and one finds very few hunters who do not favor it The deer are increasing and one sees them in regions where there have been no deer for several years. With the increase of the deer a noticeable increase in mountain lion signs are also seen. Several lions have been killed, and many of the better class of sportsmen are talking of plans to rid the range of this pest. Our greatest trouble, however, is not the lion, but the unscrupulous hunter who sneaks over the boundary of the refuge.

A NEW GAME FARMING PROJECT.

A beautifully illustrated prospectus entitled Wisconsin Zoological Park, for the Propagation, Improvement, and Utilization of Wild Life has recently been issued by a newly-formed corporation with headquarters in Chicago. The intent of the organization is set forth as follows:

Food, it is said, will win this war. And it therefore becomes the duty of everyone to give careful consideration to all plans to increase our food supply.

The American farmers, responding to their country's call, are planting every available foot of their land, which means that we have about reached our maximum in food production unless we can devise some way of utilizing the undeveloped regions. Naturally, our thoughts turn to the nearby cut-over timber lands as a possible solution of this problem. We all understand the difficulties that have presented an almost insurmountable barrier to the development of these sections and the necessity, on account of the scarcity of labor, of finding some use for this land without having to clear away stumps, rocks and timber.

The Wisconsin Zoological Park was created chiefly for the purpose of dealing with this problem. It proposes that these lands be used just as they are, in the breeding and raising of wild life objects as a source of supply.

This is a comparatively new idea, and to be understood and appreciated must be carefully studied. The purpose of this booklet is to explain some of the most important features of this enterprise.

This company proposes to demonstrate in a practical manner how cut-over land can be quickly and profitably utilized in accordance with the ideas above set forth, and at the same time carry on extensive experiments towards the development, improvement and preservation of wild animals.

It is hoped the company will become self-sustaining, but if it does not, those responsible for it have not been actuated by selfish motives. They appreciate that pioneers in any great enterprise must take chances of loss, but are confident of their ability to eventually work out a plan which can be followed with profit by others.

To the uninitiated the plan is a very plausible one, and it will doubtless appeal to many. In view, however, of the success thus far attained in game farming, the outcome of the project as a commercial enterprise seems doubtful. If it will lead to the setting aside of large areas as breeding grounds for native animals, it will be very much worth while.

LOUISIANA ORIGINATES NEW DUCK.

The Department of Conservation of the state of Louisiana is attempting to secure a new duck for their marshes by breeding. The experiments are being carried out on the assumption that if a cross between the summer mallard or black duck and the winter visitant greenhead mallard could be established a race of nonmigratory ducks could be produced for the Louisiana marshes. The new type of mallard is in the third generation and a type has been selected which appears to have characteristics of both the mallard and the black duck. Whether the new duck will become a permanently resident bird capable of being introduced remains to be seen.

ALASKA FISHERY PRODUCTS.

The Fisheries Service Bulletin states that although final figures showing the value of the fishery products of Alaska in 1917 are not yet obtainable, the statistics are practically complete so that a reasonably accurate statement of production can now be made. Compilations indicate that the total value of such products was $51,405,260 in 1917. Of this amount 93 per cent, or $47,778,081, represents the value of the salmon products which consist of 5,947,286 cases of canned salmon, valued at $46,304,090, and 16,347,367 pounds of mild-cured, pickled, dry-salted, fresh and frozen salmon, valued at $1,473,991. The halibut fish-

eries rank second with an output of products valued at $1,120,226. In the order of production, the herring fisheries come next, with a yield of products valued at $767,729. The value of the cod products was $744,976. Whaling operations returned products worth $653,852. The production of miscellaneous fishery products including clams and other shellfish aggregated $340,396 in value.

This unprecedented yield of fishery products in Alaska at a time when the world is in need of food is called an achievement for which the country may justly feel gratified.

The fur products of Alaska are also of considerable importance and value, as evidenced by the fact that in the year from November 16, 1916, to November 15, 1917, shipments from that territory reached an aggregate value of $1,031,638, exclusive of fur-seal skins and fox skins shipped by the government from the Pribilof Islands. In the calendar year 1917 the government shipped from the Pribilof Islands fur-seal skins valued at $274,291 and fox skins valued at $35,680. —*Science*, June 7, 1918.

NOVA SCOTIA USES WAR METHODS TO CAPTURE VIOLATORS.

The fact that most of the illegal fishing in Nova Scotia has been carried on by gangs of men in the darkest hours of the night when it is impossible to discover the offenders without some means of artificial illumination has prompted authorities to furnish wardens with "Trench Light" pistols. These lights which have been very effective by the allied armies and navies are contained in metallic cartridges and are fired from a breach loading four-bore pistol which throws the magnesium stars to a distance of 400 or 500 feet. The lights burn for five or ten seconds and light up the whole neighborhood so that everything can be distinctly seen even on the darkest night. In addition to its efficacy in illuminating, it acts as a weapon of self-defense which poachers will learn to fear as much as the revolver. The "trench light" has been decided upon only after experiments with acetyline searchlights, electric searchlights, and magnesium Roman candles.

CALIFORNIA TRAPPERS AND THEIR CATCH.

For the open season 1917-18, nearly 4000 trappers' licenses were issued. As the trappers' license law provides for the killing of fur-bearers destroying poultry and domestic animals, no record can be obtained of those so killed and the reports of trappers of the take for the year do not give the total number of animals taken. However, the reports do give a basis for a computation as to the value of the annual take of furs. According to the reports of those holding trappers' licenses the take for last year was as follows:

Species	Number taken	Average price
Skunk	10,480	$1 74
Mink	804	2 95
Pine marten	127	5 90
Fisher	28	
Weasel	59	
Badger	82	
Raccoon	2,309	1 87
Ring-tailed cat	1,381	40
River otter	25	
Fox	2,268	2 16
Bear	55	
Coyote	1,941	3 00
Mountain lion	7	
Wild cat	1,488	1 73
House cat	111	
Opossum	18	
Muskrat	60	
Woodrat	90	
Mole	3	

The wolverine is apparently a very rare furbearer and not a single skin of this animal was reported. It is also interesting to note that such well-known furbearers as the marten and fisher are so reduced in numbers in this state that only a small number were taken in 1917-18. The average price indicated was obtained by averaging the amount received for at least 100 different pelts of a species.

FACTS OF CURRENT INTEREST.

A recent report from the United States Supreme Court does not concern the present regulations regarding migratory birds, but relates to the regulations in effect previous to the signing of the treaty with Canada. The present regulations are based on a treaty and will be in effect for fifteen years, unless abrogated by consent of both contracting parties. Because the present regulations are based on a treaty they can not be reviewed by any court.

* * *

On information furnished by deputies of the Fish and Game Commission three violators of the Federal Migratory Bird Treaty Act have been arrested and each is being held under a $250.00 bond.

* * *

Steelhead trout fishing in the Russian River will be excellent this year. The bar is open and there is plenty of water.

* * *

February 1 will mark the close of one of the best quail seasons in many years.

* * *

The elimination of market hunting by federal enactment has reduced to a minimum violations of the laws protecting waterfowl.

* * *

The game refuges created by the last legislature have now been posted and hunters will have no excuse for hunting within them.

* * *

Plans are being made to secure some moving pictures of the commercial fisheries of southern California to be used in educational work.

* * *

The State Game Farm at Hayward was discontinued on November 16, 1918.

* * *

Deputies of the Fish and Game Commission in the areas where there is waterfowl shooting have been appointed federal wardens. Twenty-one deputies now hold federal commissions.

* * *

Federal permits allowing a rice grower to herd ducks from his fields put a stop to agitation relative to depredations by ducks. No appreciable damage to rice when in the shock was reported.

* * *

The epidemic of duck disease in the vicinity of the Marysville Buttes was of short duration and less serious than similar epidemics which have occurred at Tulare Lake in past years.

HATCHERY NOTES.

W. H. SHEBLEY, Editor.

FISH DISTRIBUTION, 1918.

While the fish distribution operations for all of the hatcheries were completed by the forepart of October, complete reports have not, as yet, been filed. However, it is possible to give an approximation of the total distribution from the different stations for the season of 1918.

MT. WHITNEY HATCHERY.

The past season has been most favorable for operations at the Mount Whitney Hatchery, and the trout distributed were some of the finest fish ever reared at any of our hatcheries. Some of the eastern brook and Loch Leven trout distributed this year were from four to five inches in length, which is a very remarkable growth for one summer. Following is an approximation of the number of fish distributed:

1,000,000 rainbow trout.
83,000 eastern brook trout.
70,000 Loch Leven trout.
240,000 steelhead trout.
240,000 black-spotted trout.
400,000 golden trout.

The golden trout eggs were obtained from the Cottonwood Lakes Station, which was established for the purpose. Owing to the remoteness of this station from railroad lines and the rough, almost inaccessible country through which the eggs had to be carried by pack animal to the Mount Whitney Hatchery, the extent

Fig. 17. Wild geese at fish pond, Mount Shasta Hatchery, September 30, 1918. Photograph by J. L. Stinnett.

MT. SHASTA HATCHERY.

The approximate total number of fish distributed for the season was as follows:

13,500,000 quinnat salmon.
2,600,000 rainbow trout.
1,100,000 eastern brook trout.
1,600,000 Loch Leven trout.
2,000,000 steelhead trout.
230,000 black-spotted trout.

Two fish distribution cars were operated during most of the distributing season. The fish were all strong and healthy, and nearly all applicants reported that consignments were received and planted in the streams in good condition. Mount Shasta Hatchery is now being put in readiness for the coming season's trout operations and for the salmon work.

of our operations was necessarily limited, but we feel that the results obtained have justified all the hard work and expense. Although several efforts have been made in past years to collect the eggs of the golden trout, this is the first attempt that has been successful. The success of the operations this season is due to the skill and resourcefulness of Mr. George McCloud, Jr., who was in personal charge of the golden trout egg collecting operations at Cottonwood Lakes and of the Mount Whitney Hatchery, at which station the eggs were hatched and the fry reared. The golden trout are very difficult to rear, but the results obtained in this delicate work far exceeded our expectations.

Plants of golden trout were made in the Santa Ana River, San Bernardino County, and in Mammoth Creek and Convict Lake, Mono County. A shipment of golden trout was planted in Lake Tahoe, and a consignment sent to Mount Shasta Hatchery to be liberated in the McCloud River at a later date. Practically all of the waters of southern California and the lower San Joaquin Valley counties were stocked with fish from the Mount Whitney Hatchery this season.

Fish Distribution Car No. 01 was detached from distribution operations at Mount Shasta Hatchery the forepart of September and sent to southern California to undertake the shipping of fish from the Mount Whitney Hatchery. The work was completed in a little over a month. After the completion of the season's fish-cultural operations the crew was assigned to make the improvements on the Mount Whitney Hatchery grounds, and this work is now progressing nicely.

MT. TALLAC HATCHERY.

The Mount Tallac Hatchery was operated as in past seasons, black-spotted trout eggs being taken from the fish ascending Taylor Creek to spawn. In addition to the 1,200,000 eggs of this species hatched at the station for distribution in the tributary streams of Lake Tahoe in the vicinity of Mount Tallac, shipments of eggs were made to Tahoe Hatchery, Mount Shasta Hatchery and the Feather River Experimental Station; 150,000 rainbow and 380,000 steelhead trout fry were also distributed in the tributary streams of Lake Tahoe from Mount Tallac Hatchery this season. The steelhead trout should thrive well in the waters of Lake Tahoe, and the addition of this valuable species of trout to the other varieties in the lake will be greatly appreciated by the anglers of the state who enjoy the fishing in this region.

TAHOE HATCHERY.

From Tahoe Hatchery were distributed 15,000 rainbow and 420,000 black-spotted trout fry in the streams and lakes in the Tahoe Basin and in the vicinity of Truckee.

FORT SEWARD HATCHERY.

The streams of Humboldt and Trinity counties were stocked with rainbow and steelhead trout fry to the number of 200,000 and 1,000,000 respectively from Fort Seward Hatchery this season. Mad River, tributaries of Humboldt Bay, and Eel River and tributaries, received most of the fish.

Quinnat salmon eggs received from egg collecting operations on Eel River near Bryan's Rest last fall were hatched at Fort Seward Hatchery, together with shipments of eggs of the same species from Mount Shasta Hatchery, and the resulting fry to the number of 1,000,000 were planted in Mad River, tributaries of Humboldt Bay and Eel River. As egg collecting operations near Bryan's Rest were not satisfactory, a new experimental station was established this fall on Bull Creek, a tributary of Eel River, near Dyerville. Owing to the fact that there was not enough rainfall to raise the river sufficiently to enable the spawning fish to ascend the stream, no Quinnat salmon eggs were taken early in the season, but later rains during the month of November improved conditions.

DOMINGO SPRINGS STATION.

The season's operations at Domingo Springs Hatchery were very successful. In addition to the rainbow trout eggs sent to other hatcheries, 317,000 were hatched and the fry planted in lakes and streams in Lassen and Placer counties. A shipment of 100,000 steelhead eggs was sent to Domingo Springs, and the resulting fry planted in lakes in that vicinity.

UKIAH HATCHERY.

The streams of Mendocino and Sonoma counties received their usual portions of steelhead trout fry from Ukiah Hatchery this season, 420,000 fish being planted in the two counties.

ALMANOR HATCHERY.

Egg collecting operations at Almanor Hatchery resulted in a take of less than 200,000 rainbow eggs. The resulting fry were distributed in Lake Almanor and near-by streams.

FEATHER RIVER HATCHERY.

Operations at the experimental station established near Blairsden on the Western Pacific Railroad were not successful, as the water supply from Grey Eagle Creek did not prove to be satisfactory for fish-cultural operations. Rainbow and black-spotted eggs were shipped to the station to be hatched and reared, but they died in great numbers both before and after hatching. The station has been dismantled, and the equipment will be used at one of the other stations.

BEAR LAKE HATCHERY.

Fish distribution operations were finished on September 5, and the station closed after completing the most successful season since the hatchery was established. At the egg collecting station on North Creek, 3,500,000 rainbow eggs were taken. After being "eyed," they were shipped to Mount Shasta, Mount Whitney, Tahoe, and Bear Lake Hatchery at Green Spot Springs; 300,000 were also hatched at the North Creek Station, and planted in Big Bear Lake. A total of 1,075,000 rainbow trout fry were distributed in streams of San Bernardino County, and in Big Bear Lake, from Bear Lake and North Creek stations. At the present time assistants are engaged in making repairs and improvements at the two stations. Negotiations are now under way for the purchase of a fine power boat for use in egg collecting operations, transferring materials and supplies, etc., which will greatly facilitate the work next spring.

BROOKDALE HATCHERY.

Steelhead trout fry to the number of 700,000 were distributed in the streams of Santa Cruz and Santa Clara counties from Brookdale Hatchery this season, in addition to shipments of steelhead eggs made to Mount Shasta and Mount Whitney hatcheries for distribution in other sections of the state.

WAWONA HATCHERY.

The completion of the new hatchery at Wawona enabled us to handle the fish to much better advantage this year. Streams in the vicinity of Wawona received 75,000 rainbow and 195,000 steelhead trout fry.

CLEAR CREEK HATCHERY.

A small hatchery has just been completed on Clear Creek, Lassen County, near Westwood. Eggs will be shipped to this station from Almanor and Domingo Springs hatcheries next season, and the fry hatched for distribution in the streams in the vicinity of Westwood.

KLAMATH RIVER STATION.

The new Klamath River Hatchery, which is being constructed by the California-Oregon Power Company, and which will be turned over to the California Fish and Game Commission when completed, in lieu of the construction of a fish ladder over the Copco Dam, is well under way. As it was not possible to complete this hatchery in time to trap this year's run of Quinnat salmon, a temporary station was established at Klamathon. Owing to the failure of the main run of salmon to reach the point at which the racks are located, on account of the long dry fall, the take is therefore much below normal.

COMMERCIAL FISHERY NOTES.

N. B. Scofield, Editor.

TIDE CONDITIONS INJURE FISHERIES.

The unusual conditions of water temperature and currents along the California coast during the past summer were largely responsible for a greatly reduced catch of albacore in southern California and evidently caused the appearance of new and strange fishes as elsewhere noted in this magazine. They also affected the catch of sardines and salmon and seriously handicapped the

growth of kelp. For nearly five months sardines were not found in sufficient numbers in southern California to keep the canneries busy.

Kelp. The kelp on the surface of the water ceased to grow and the serious shortage of this seaweed which occurred made it very difficult for the kelp potash companies to secure enough to supply their plants. It is feared that even the new shoots, which come up and take the place of the long stipes on the surface of the water after they have been cut, have been killed. The best growing time of the kelp has usually been in the winter months. Just how the stunted summer growth will affect the growth during this winter is as yet unknown.

It is now quite certain that the close of the war will have the effect of putting many of the California kelp potash companies out of business. Before the war the price of potash was about $65 per ton, but for the past year it has been between $250 and $350 per ton. If the price of potash decreases one-half, the majority of the companies will have to cease operations. Already the demand for potash to be used in the manufacture of munitions of war has ceased to exist. The immense plant of the Hercules Powder Company near San Diego has discontinued harvesting kelp and has issued notice to its one thousand employees that shortly their services will not be required. This company has done a great deal of investigation work in developing important by-products through the manufacture of which they expected to be able to continue operations even after the close of the war, but it has finally been decided that in view of the market prices that will have to be met shortly and the entire lack at present of a market for certain of the by-products, it will be best to reduce the operations of the plant to a very small scale and only two or three by-products will be produced there with a small force.

Salmon. The salmon catch at Monterey during the summer was only about half the usual amount. The fish almost entirely disappeared before the end of May. The catch for June, which is usually large, was a failure. But the fish which escaped the hooks of the fishermen in Monterey Bay later made their appearance in San Francisco Bay and the Sacramento River on their way to cast their spawn in the river's headwaters. Their appearance in the river was much later than usual and at the time when the fishermen and salmon packers were importuning the Fish and Game Commission and the Federal Food Administration to extend the season the salmon put in their appearance in great numbers. For a period of two weeks the salmon kept coming in such numbers that sufficient help could not be obtained to take care of the catch. The final result has been that the combined catch of Monterey Bay and the Sacramento River was the largest for several years. The amount of salmon taken up to the end of September in Monterey Bay, outside of the Golden Gate, San Francisco Bay and the Sacramento River was 11,040,075 pounds.

The catch of salmon by trolling at Fort Bragg was good; the total amount of the catch reaching a million and a quarter pounds. The run at Eel River was considered a failure, the amount taken being less than half the usual catch. The run on the Klamath River also shows a falling off.

THE SALMON INDUSTRY MENACED.

To dam the waters of the Sacramento at the narrow Iron Canyon above Red Bluff and thus make an immense impounding reservoir for flood control and irrigation purposes, has for years been a dream of those who would develop the resources of the upper Sacramento Valley and of those who have been interested in controlling the floods on the lower river. There have been frequent efforts to make this dream come true, but it is only recently that there have been hopes of its realization.

It is now proposed by assessing the land in the area to be benefited and by the aid of the state and the United States government to raise $20,000,000 for the construction of the dam and irrigation canals. The site of the dam is seven miles above Red Bluff. The proposed dam will be so high that salmon ascending the river to cast their spawn will not be able to pass even by means of the best "fish ladders" which have been devised. An impassable dam at the Iron Canyon will cut the salmon off from all the upper tributaries in which they naturally spawn, with the exception of Mill

Creek. If remedial measures can not be devised three-fourths of the present salmon run will be lost.

Remedies which suggest themselves are to attempt to establish runs in other streams, especially in tributaries of the San Joaquin and to establish a hatchery at the dam. Many difficulties present themselves in any plan to catch salmon at the dam, chief of which is unsuitable water temperature. Salmon of the spring run will not be mature enough to warrant holding at the dam for spawning purposes and if eggs are collected at the dam from the summer and fall run, the water available for the hatching will be too warm. Even if the eggs could be held in a hatchery at the dam until they are "eyed" at which stage they could be shipped to other hatcheries more favorably located on the river above, there would still be the problem of getting the resulting fry down over the dam in their seaward migration.

If such a dam is built, and it appears now it will be built, the salmon industry is sure to suffer an irreparable loss.

SPERM WHALE TAKEN OFF MONTEREY.

On November 21, Monterey fishermen found a dead sperm whale off Point Pinos near Monterey. They towed the carcass to Monterey where it was sold to one of the local fish concerns for $300. The length of the whale was 65 feet and it produced ten barrels of case oil. This species of whale is very scarce on this coast, and according to old residents of Monterey this is the first sperm whale that has been taken in that region for at least forty years.

LOCATING SARDINES BY AEROPLANE.

The serious shortage of sardines in southern California during the past summer has suggested the idea of locating the schools of sardines by means of aeroplanes. The great difficulty in catching sardines is in locating the schools of fish. On account of light on the surface of the water it is difficult to locate a school of sardines unless the boat runs into them. Fishing is usually carried on at night, at which time the phosphorescent glow caused by the swimming fish is more easily seen, but even at night this phosphorescent light can be seen only a short distance. It is a well-known fact that schools of fish can be more easily seen from an elevation where the observer is away from the glare of the reflected light at the surface of the water. From an aeroplane schools of fish are easily seen which are invisible to a person from the deck of a boat. At such times as fishermen are unable to locate schools of sardines, or of albacore for that matter, it would be practicable to employ an aeroplane for the purpose, which adds one more argument for those who would commercialize the aeroplane.

NEW WHALING STATION ON MONTEREY BAY.

The California Sea Products Company has almost completed a large, modern, fully equipped whaling station at Moss Landing on Monterey Bay, which will employ forty men when in operation. In addition to the whaling plant this company expects in time to operate a sardine cannery and during off seasons to use their boats to supply fish to the fresh fish trade.

There has been some objection to the establishment of a whaling station on Monterey Bay for fear that it would injure the sardine industry, under the belief that it is the whales that drive the sardines into the bay. This is an old belief which comes to us from the European coast where at one time it was believed whales drove the herring into the sheltered waters of the bays and fjords. Herring do not enter sheltered waters along the coast to escape whales, but for the purpose of spawning in the shallow waters where their eggs are attached to rocks and seaweed. There is no evidence that whales drive sardines into bays.

NEW FISH NET.

A new fish net has been devised for catching sardines and other small fish known as the purse-lompara net. This net is in use at Monterey and is in all respects a lompara net except that a purse line has been added to the bunt of the net which enables the operators to pull the lead line in more quickly after the net is partly in, thus impounding the fish in the bunt of the net. With this net it is easier to catch sardines in the day time without their sounding and getting under the net when it is operated in deep water. By using this semipurse arrangement a shallower net than otherwise can be used, which makes its operation quicker and more economical.

CONSERVATION IN OTHER STATES.

CONSERVATION LESSONS FROM MASSACHUSETTS.

The Massachusetts Fish and Game Commissioners are calling attention to the need of the conservation of fish by means of "little lessons." One of them follows:

"The advance of civilization always decreases the natural fish and game supply. Preach and practice conservation.

"Don't take fish that are full of spawn; leave them to deposit their eggs and the small to grow into mature fish.

"Don't take more than you need.

"Don't try for the largest number; try for the largest fish.

"Don't try to get the last one; leave some for others.

"Report violations to the Fish and Game Commissioners.

"Remember, this is your sport. No one is as interested in it as the hunters and fishermen, and it is up to you to make or ruin it."—*American Field*, May 2, 1918.

CATS BECOME GAME IN NEW YORK.

In New York a bill has been passed, permitting any person over twenty-one years of age who holds a hunting or trapping license to destroy humanely a cat at large found hunting or killing any protected bird, or with such a bird in its possession. The bill makes it the duty of the game protectors to kill all offending cats.

MINNESOTA GAME REFUGES.

In the State of Minnesota state parks and state forest reserve lands have automatically become refuges for game. The legislature of 1915 provided for a practical way of establishing game refuges on privately owned land. Already seventeen refuges have been established in this way, embracing 531,925 acres. The combined area of all of the Minnesota game refuges is 1,877,813 acres. This method of protecting and restoring game has met with instant and hearty approval by the people of the state and in every instance in which a refuge has been established, there has been a unanimity of sentiment among the people interested in it.—Bien. Rpt., Minn. Fish and Game Comm., 1916.

MINNESOTA DISTRIBUTES FISH.

Under the authority of the Public Safety Commission, the state of Minnesota has been catching and distributing fish. From October 15, 1917, to January 1, 1918, the production of state-caught fish amounted to 77,851 pounds. Great care is being exercised not to take fish that are desirable for angling from localities where people can and will use lakes for that purpose. In such localities fishing is confined to rough fish only. As a contribution to the food supply the state fishing has demonstrated its importance and has proved to be popular and successful. Distribution has been made through game wardens, representatives of the Safety Commission, meat dealers and other individuals.

NEW JERSEY RESTOCKED WITH RABBITS.

The game farm of the New Jersey State Fish and Game Commission has two thousand rabbits which will be distributed throughout the state. Rabbits will be placed in districts where they have been hunted out.

LIFE HISTORY NOTES.

TREE-DUCKS SUCCESSFULLY BRED IN SANTA CLARA COUNTY.

A pair of fulvous tree-ducks (*Dendrocygna bicolor*) were secured from the State Game Farm in the fall of 1916 and placed on my pond at Cupertino. In June, 1917, I had a suspicion that they were laying, as I found several eggs which I could not classify in different parts of the enclosure. I have learned from experience that one can not disturb ducks during the laying and breeding season, and in the past I know that I have broken up several "settings" because of my curiosity. In June of this year I noted from casual observance that only

one of my fulvous ducks was on the pond, and fearing that the other had been lost or had died, I started an investigation and after some days found the nest very close to the water's edge on a ledge of rock in a rustic rockery constructed in the pond for ornamental purposes. This ledge was concealed by overhanging vines and it was very difficult for me to see it. Not wishing to disturb the birds, I did not make a close investigation, but as near as I could tell, there were five or more eggs in the nest. (This last is somewhat of a guess on my part.) As the birds seemed to be sitting, I left the nest severely alone, and some time around the 20th of June (I can not give the exact date) I was rewarded in seeing the mother duck bring out four young ones into the pond. These little birds did not appear to me to be much larger than young quail and I used my very best efforts in an attempt to segregate them, but without avail. My present pond is not constructed properly for breeding purposes, having been erected in the first instance purely for ornamental purposes, and the birds have not access to and from the water at all points, with the result that these little ducks became chilled and drowned, or were molested by the other ducks, all dying within four or five days. —J. V. DeLaveaga.

RARE FISH FROM MONTEREY BAY.

The true halibut (*Hippoglossus hippoglossus*) was occasionally taken this last summer (1918) in Monterey Bay. It has not been reported before south of San Francisco.

A specimen of a fish sometimes called the "blacksmith" (*Chromis punctipinnis*) was brought to Hopkins' Marine Station at Pacific Grove by Japanese fishermen this summer. This fish has hitherto been unknown north of the Santa Barbara Channel.—E. C. Starks.

MARLIN-SPIKE FISH USED AS FOOD.

The marlin-spike fish (*Tetrapterus nutsukurii*) now being caught by anglers near Santa Catalina Island is finding a good market in Los Angeles at a retail price of 25 cents per pound. It is said to be undistinguishable in taste from the swordfish. The writer recently enjoyed eating some of it, and found it one of the most delicious fishes he had ever tasted. Fresh tuna was served at the same time for comparison. It was much coarser fleshed and much less delicately flavored than the marlin-spike fish.—E. C. Starks.

BREEDING OF THE FULVOUS TREE-DUCK IN SANTA CLARA COUNTY.

Early in the month of November, 1917, a fulvous tree-duck (*Dendrocygna bicolor*) was brought to me for identification by Miss Ethel Emerson. It had been caught when but a downy bird in the salt marsh near Mountain View, Santa Clara County, and was now nearly grown. Several others taken at the same time had died, one by one in captivity, but the survivor, when placed in a large cage with a pair of bantams, soon became very active and contented. Later its plaintive whistle might be frequently heard during the night, and at times it seemed to show irritation at close confinement. It remained wild and was easily frightened at the approach of people or other animals, as dogs and cats. When opportunity offered it made its escape after having spent somewhat over a year in captivity.

The most interesting point in all this is that it appears to furnish the first account of the breeding of the species in the marshes of San Francisco Bay, and I believe that the bird has not been recorded before in Santa Clara County. —J. O. Snyder.

BANDED PINTAIL TAKEN IN ALAMEDA COUNTY.

On November 13, 1918, I shot at Alvarado, California, a pintail duck (*Dafila acuta*) bearing a metal band stamped "U. S. Biological Survey, No. 4009." Upon returning this band to Washington the following information was obtained:

The duck was captured while sick with alkali poisoning at Utah Lake, cured and banded October 10, 1916, after which it was exhibited with others at the Utah State Fair, and released. Its capture is good evidence of the permanence of the cure, and is of interest because of the fact that over two years intervened between capture and the date of banding.—Earle Downing.

REPORTS.

CALIFORNIA FISHERY PRODUCTS—JULY, AUGUST, SEPTEMBER, 1918.

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Sacramento, San Joaquin	Alameda, Contra Costa	San Francisco, San Mateo	Santa Cruz	Monterey	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego	Total	Mexico
Albacore										918	6,183,413		816,728	7,001,059	
Anchovy	100		3,800				46,129		114,450		21,599		600	186,678	310
Barracuda							7,146	43,987	144	21,307	760,329		573,677	1,406,590	116,692
Bonito								33,361	3,930	10,243	788,023		670,169	1,505,726	2,645
Bocaccio		1,603	1,936				1,424	354	286,556					291,873	
Bluefish									31,261					31,261	
Chilipepper							907		972					1,879	
Carp				1,187	12,773	8,588	347							22,895	
Catfish		260		644	1,460	5,422								7,786	
Croakers											20,754		893	21,647	
Coalfish							85,186		37					85,223	
Cultus cod	499	11,852	6,116				224,653	42,437	20,225		1,613			307,395	
Dolphin											720			720	
Dogfish			74,920				22,570		1,985		497		6,127	106,099	2,615
Flounder	705					58	381,278	25,125	740		32			407,938	
Halibut	19,750	30,172	1,094				1,758	1,721	11,795	57,823	88,045		20,077	232,235	1,438,057
Hake							54,122	8,000	220	64			457	62,863	
Herring	174									175				349	
Kingfish							24,973	10,508	54,097	400	28,771	160	5,095	124,004	
Mackerel								620	911,577	4,280	789,377		29,650	1,735,504	41,191
Mullet															
Marlin											2,014			2,014	
Pike						274								274	
Pompano							562	333	10		1,105		100	2,110	
Perch	10,646		513				12,884	794	360	810	4,133		390	30,530	
Rock bass										3,633	171,958		98,073	273,664	3,090
Rockfish	20,059	454	342				408,698	169,887	316,584	12,761	138,361		175,558	1,242,704	4,096
Sole	25						1,349,380	651,809	71,220	23,680	2,219			2,098,333	
Salmon	511,711	676,287	136,842	1,949,735	462,984	2,806,554	1,335,939	77,618	171,155					8,128,855	
Smelt	2,054		13,984			25	56,282	11,078	107,960	7,283	19,061	1,335	7,215	226,277	70
Sea bass (white)			34				28,309	102,062	47,306	59,384	630,600	395	21,912	890,002	146,903
Sea bass (black)										2,427	33,389		31,856	67,672	2,915
Sand dab							366,604	36,852	5,762		6,802			410,020	

Suckers					765								765	
Striped bass			1,857	11,029	2,324	53,481	53,107		94				121,952	
Roe shad					43	123							166	
Shad				2,053	678	4,544	93						7,368	
Buck shad					515	5,934							6,449	
Skipjack										2,134,341	2,719	2,137,060		
Sturgeon														
Sardine	741						283,910	107,715	27,761,816	42	485,841	2,432,666	31,072,631	
Skate							41,458	390	3,210		1,237		46,295	
Sword fish											16,862		16,862	
Sculpin											3,479		3,479	
Surf fish											3,945		3,945	
Sea trout											537	276	813	
Sheepshead											526	1,376	1,902	
Tom cod							638	55			11,197		11,890	
Trout (farm)							286						286	
Trout (steelhead)	7,279												7,279	
Turbot											12		12	
Tuna								315	1,012	1,009	4,505,777	143,702	4,651,500	
Whitebait							21,068						21,068	
White fish											2,179		2,179	
Yellowtail							21,520	21,349	13,116	15,506	2,556,327	3,593,169	6,220,987	17,219
Miscellaneous	2,000				72		29,544	750		1,554	82,445	12,952	129,317	126,290
Totals	575,743	720,628	241,438	1,964,648	481,614	2,885,083	4,860,135	1,341,120	29,937,594	223,299	19,497,520	1,890	8,645,437	71,376,099	1,902,087
Crustaceans—														
Crab (doz.)	62		12				1,682		1				1,757	
Spiny lobster														
Shrimp							249,562						249,562	
Ecrevisse														
Mollusks—														
Squid							120		23,729				23,849	
Cuttlefish							2,385		294				2,679	
Clam pismo								332		206,686			207,018	
Clam cockle			6,669										6,669	
Clam softshell	1,085	3,604	38,185			51,720							94,594	
Clam mixed			3,767				35		340				4,142	
Oyster (shell) No.			425,395				1,518,335						1,943,730	
†Oyster, No.			272,021										272,021	
Abalones										95,345			95,345	
Mussels						793	1,142		123,449				125,384	

Eastern. †Native.

VIOLATIONS OF FISH AND GAME LAWS.

September 1, 1918, to December 1, 1918.

Offense	Number of arrests	Fines imposed
Game.		
Hunting without license	38	$645 00
Deer—close season—killing or possession	3	75 00
Female deer, spike bucks, fawns—killing or possession	25	607 00
Running deer with dogs, close season	1	25 00
Failure to retain portion of deer head bearing horns	7	150 00
Illegal deer hides—possession	2	100 00
Bear—close season—killing	1	
Quail—close season—killing or possession	11	325 00
Doves—close season—killing or possession	2	
Duck—close season—killing or possession, excess bag limit	7	240 00
Shooting ducks from power boat in motion	1	25 00
Cottontail and brush rabbits—close season—killing or possession	2	50 00
Rail—close season—killing or possession	1	25 00
Wild pigeon—close season—killing or possession	1	25 00
Nongame birds—killing or possession	8	70 00
Shore birds—close season—killing or possession	3	75 00
Night shooting	13	225 00
Total game violations	126	$2,662 00
Fish.		
Angling without license	5	$125 00
Fishing for profit without license	7	80 00
Fishing with nets in restricted district	6	650 00
Striped bass—underweight	8	100 00
Salmon—Saturday and Sunday fishing close season—taking or possession, excess limit	7	600 00
Clams—undersize—excess limit	3	75 00
Abalones—undersize—shipping out of state	5	75 00
Spiny lobsters—close season—taking or possession	1	
Total fish violations	42	$1,705 00
Grand total fish and game violations	168	$4,367 00

SEIZURES—FISH, GAME AND ILLEGALLY USED FISHING APPARATUS.

September 1, 1918, to December 1, 1918.

Game.		
Deer meat	194	pounds
Hides	6	
Ducks	425	
Quail	49	
Doves	1	
Shore birds	4	
Nongame birds	10	
Rabbits	8	
Miscellaneous game	10	
Fish.		
Striped bass	841	pounds
Salmon	15,665	pounds
Trout	64	pounds
Crabs	157	
Pismo clams	403	
Abalones	124	
Illegal nets	3	
Searches.		
Illegal fish and game	1	

STATEMENT OF EXPENDITURES—YEAR 1918.

Item of expense	May	June	July	August	September
General administration	$1,964 69	$1,875 49	$2,288 08	$1,844 69	$1,822 36
Research, publicity and educational (game)	422 19	309 83	333 24	259 40	363 99
Printing	262 48	45 00	769 95	511 84	
Fish exhibits		5 50			
Game exhibits		3 50			
Game farm	307 07	249 99	265 26	286 32	174 15
Mountain lion bounties	290 00	170 00	380 00	130 00	180 00
Lithographing hunting licenses	995 00				
Lithographing angling licenses					
Hunting license commissions	1,681 70	596 60	807 70	692 50	2,857 00
Angling license commissions	709 10	1,100 90	1,500 90	380 50	1,243 90
Market fishing license commissions	309 75	41 50	47 50	73 50	53 00
	$6,941 98	$4,398 31	$6,392 63	$4,178 75	$6,694 40
San Francisco district	$5,334 17	$5,788 45	$5,933 32	$6,398 24	$6,241 56
Sacramento district	3,542 81	3,704 20	4,036 63	3,905 00	4,003 60
Los Angeles district	2,537 28	2,462 45	2,304 00	2,128 17	2,491 26
Launch patrol	903 72	1,056 29	1,350 96	1,209 66	924 31
Prosecutions (fish and game)	104 75	318 49	93 50	73 75	87 85
Crawfish inspection	33 33				
Winter game feeding					
Accident and death claims	124 04	155 05	185 19	186 35	124 04
	$12,580 10	$13,484 93	$13,903 60	$13,901 17	$13,872 62
Hatchery administration	$1,030 65	$841 61	$1,081 33	$817 63	$1,040 83
Mount Shasta hatchery	1,544 41	2,024 76	3,812 12	6,679 96	3,090 54
Klamath station	6 60	5 60			803 99
Mount Whitney hatchery	2,168 48	1,974 57	1,774 34	2,512 81	2,204 94
Cottonwood Lakes station	58 48	675 60	196 10	45	
Tahoe hatchery	40 19	96 00	205 19	236 38	299 30
Tallac hatchery	886 16	405 06	469 74	206 01	67 85
Fort Seward hatchery	500 61	461 69	398 41	283 80	100 00
Eel River station				4 75	486 50
Ukiah hatchery	448 30	293 64	187 30	187 83	5 20
Snow Mountain station	155 60	100 00			
Brookdale hatchery	220 09	203 72	291 16	340 13	201 61

STATEMENT OF EXPENDITURES—Continued.

Item of expense	May	June	July	August	September
Scott Creek station	$76 00	$30 00	$167 00	$31 00	$30 00
Feather River hatchery	521 27	494 56	158 06	20 15	
Almanor hatchery	719 20	146 00	113 10	190 10	4 80
Domingo Springs hatchery	203 80	137 72	159 55	263 33	366 42
Clear Creek hatchery					27 93
Bear Lake hatchery	566 83	402 85	247 47	336 84	202 10
North Creek station					
Wawona hatchery	114 80	668 00	96 19	24 35	
Yosemite hatchery					
Fish distribution	373 68	963 15			
Fish transplantation			4 56	3 00	3 00
Screen, fishway and water pollution	473 36	566 19	1,022 78	544 51	409 83
Special field investigations			205 50	60 00	
	$10,108 51	$10,490 72	$10,589 90	$12,743 03	$9,344 84
Department of Commercial Fisheries	1,927 83	2,765 49	2,611 32	2,598 85	1,846 93
	$31,558 42	$31,139 45	$33,497 45	$33,421 80	$31,758 79
Department of Engineering—					
Launch "Albacore"		$3,709 42	$43 40		
Yosemite hatchery					$327 27

42766 1-19 5M

PATROL SERVICE.

SAN FRANCISCO DIVISION.

E. L. Bosqui, Commissioner in Charge. Carl Westerfeld, Executive Officer.

J. S. Hunter, Assistant Executive Officer. E. C. Boucher, Special Agent.

Head Office, New Call Building, San Francisco.

Phone Sutter 6100.

W. H. Armstrong—Vallejo
Earl P. Barnes—Eureka
Theo. M. Benson—Fortuna
O. P. Brownlow—Porterville
F. A. Bullard—Dunlap
J. L. Bundock—Oakland
J. Burke—Colma
M. S. Clark—San Francisco
S. L. N. Ellis—Fresno
J. H. Hellard—Laytonville
J. H. Hill—Watsonville
D. H. Hoen—San Rafael
R. S. Kimball—Merced
I. L. Koppel—San Jose
Henry Lencioni—Santa Rosa
Albert Mack—San Francisco
B. H. Miller—Ukiah
E. V. Moody—Santa Cruz
W. J. Moore—Napa
F. B. Nesbitt—Salinas
J. E. Newsome—Newman
Chas. R. Perkins—Fort Bragg
Frank Shook—Salinas City
E. W. Smalley—Hanford
H. E. Foster—Launch "Quinnat," Vallejo
Chas. Bouton—Launch "Quinnat," Vallejo

SACRAMENTO DIVISION.

F. M. Newbert, Commissioner in Charge.

Geo. Neale, Assistant.

Forum Building, Sacramento.

Phone Main 4300.

T. W. Birmingham—Sutter Creek
E. W. Bolt (Enlisted U. S. Navy)—Gridley
S. J. Carpenter—Maxwell
Geo. W. Courtright—Canby
Euell Gray—Placerville
W. J. Green—Sacramento
G. O. Laws—Weaverville
Roy Ludlum—Los Molinos
R. C. O'Connor—Grass Valley
E. D. Ricketts—Live Oak
D. E. Roberts—Murphys
J. Sanders—Truckee
C. A. Scroggs—Loomis
R. L. Sinkey—Woodland
L. J. Warren—Taylorsville
J. S. White—Castella

LOS ANGELES DIVISION.

M. J. Connell, Commissioner in Charge.

E. A. McKee, Assistant. Edwin L. Hedderly, Assistant.

Union League Building, Los Angeles.

Phones: Broadway 1155; Home, F 5705.

H. J. Abels—Santa Maria
J. J. Barnett—Ventura
H. D. Becker—San Luis Obispo
J. H. Gyger—Elsinore
W. C. Malone—San Bernardino
E. H. Ober—Big Pine
H. I. Pritchard—Los Angeles
A. J. Stout—Los Angeles
Webb Toms—San Diego

ABSTRACT CALIFORNIA FISH AND GAME LAWS

WHITE SQUARES INDICATE OPEN SEASON. NUMBERS IN SQUARES ARE OPEN DATES

	DISTRICTS	JAN.	FEB.	MAR.	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	BAG LIMITS, ETC.
DEER	1-23-24-25-26								15		14			No Does, Fawns or Spike Bucks No sale of venison Two Bucks per season See Notes 1-2-8-9-10 on back of this abstract
	2-3									14				
	4													
RABBITS, COTTONTAIL AND BRUSH	ALL												15	15 per day. 30 per week
TREE SQUIRRELS	ALL													12 per season
ELK, ANTELOPE, MOUNTAIN SHEEP	ALL													KILLING OF ELK OR POSSESSION OF ELK MEAT A FELONY
SEA OTTER, BEAVER	ALL													$1,000 Fine for Sea Otter
BEAR, BLACK AND BROWN	ALL			1										SEE NOTE 11 ON BACK OF THIS ABSTRACT
FUR BEARING MAMMALS	ALL			1										SEE NOTES 11-12 ON BACK OF THIS ABSTRACT
Ducks, Geese, Jack Snipe, Mud Hens	ALL										14			SEE NOTES 6-14-15-17 ON BACK OF THIS ABSTRACT
RAIL, WOOD DUCK, WILD PIGEON SHORE BIRDS (Except Jack Snipe)	ALL													
QUAIL, VALLEY AND DESERT	ALL												15	15 per day. 30 per week
MOUNTAIN QUAIL	1-23-24-25-26													10 per day 20 per week
	2-3-4												15	
SAGE HEN	ALL (EXCEPT 4)								15					4 per day 8 per week
	4													
DOVE	ALL (EXCEPT 1)													15 per day
	1													
GROUSE	ALL									15	14			4 per day. 8 per week
TROUT (Except Golden) **WHITEFISH**	1													50 Fish or 10 Pounds and one Fish, or one Fish weighing 10 Pounds or over per day. In districts 2 and 3 during the winter season 5 fish per day
	2-3												15	
	4													
	23-24-25					20								SEE NOTES 25-38-40 ON BACK OF THIS ABSTRACT
	23													SEE NOTE 27 ON BACK OF THIS ABSTRACT
	Lakes													SEE NOTE 26 ON BACK OF THIS ABSTRACT
GOLDEN TROUT	ALL						30				1			20 per day. None under 5 inches
BLACK BASS	ALL													25 per day None under 7 inches NO SALE Hook and line only
	Clear Lake & Lake Co.													
SACRAMENTO PERCH, SUNFISH AND CRAPPIE	ALL													25 per day. Hook and line only
STRIPED BASS, SHAD	ALL													SEE NOTE 24 ON BACK OF THIS ABSTRACT
SALMON	ALL (EXCEPT 15)													SEE NOTE 28 ON BACK OF THIS ABSTRACT
	15				15									
CATFISH	ALL					14			15					Closed season only for commercial fishing
CRABS	ALL							30					15	SEE NOTE 29 ON BACK OF THIS ABSTRACT
ABALONES RED	ALL													SEE NOTE 34 ON BACK OF THIS ABSTRACT
ABALONES GREEN, PINK, BLACK	ALL													
PISMO CLAMS	17													SEE NOTE 33 ON BACK OF THIS ABSTRACT

FOR LAWS IN FULL SEE PENAL CODE. FOR COMMERCIAL FISHING LAWS SEE MARKET FISHING ABSTRACT

DISTRICTS 1a, 1b, 1c, 1d, 1e, 1f, 1g, 1h, 1i, 1j, 1k, 1l, 2a, 3a, 3b, 3c, 3d, 4a, 4b, 4c, 4d, 4e, 4f, are game refuges. Hunting forbidden. Fishing in accordance with law relating to main district in which refuge is located. (See map.)

Hunting Licenses: Residents, $1.00; Non-residents, $10; Aliens, $25. License year from July 1 to June 30

Angling Licenses: Residents, $1.00; Non-residents, $3; Aliens, $3. License year from Jan. 1 to Dec. 31

Trapping Licenses from Fish and Game Commission

Trapping Licenses: Citizens, $1.00; Aliens, $2.00. License year from July 1 to June 30.

Hunting and Angling Licenses can be secured from Fish and Game Commission, County Clerks and License Agents.